Vol. 32 No. 11

BULLETIN

OF THE

TORREY BOTANICAL CLUB

NOVEMBER, 1905

Phycological studies—II. New Chlorophyceae, new Rhodophyceae, and miscellaneous notes *

MARSHALL AVERY HOWE

(WITH PLATES 23–29)

A. NEW CHLOROPHYCEAE

Halimeda favulosa sp. nov.

Of a light bright-green when living, often albescent or yellowish on drying, rather flaccid, suberect or more commonly decumbent (especially if uncovered at low tide), somewhat easily friable when dry, the surface then strongly favulose even to the naked eye and with a subcrystalline lustre; plants reaching a height or length of 9–22 cm., usually of congested habit, the numerous branches mostly originating near the very short, flattened stipe, this consisting of 1–4 more or less fused segments: rhizoids forming a bulbous mass with the adherent granules of sand: segments variable in form, ranging, without apparent order, from discoid and often trilobed to cylindrical and entire in different parts of a single individual, 4–9 mm. long, 2–9 mm. broad, 0.5–2 mm. thick: peripheral utricles turbinate, subcrateriform, obovoid, or pestle-shaped, 150–400 μ long, 110–260 μ in diameter in surface view, supported and separated by calcareous calyces, the exposed rounded-obtuse or truncate apical portion strongly collapsed on drying, even the whole utricle often withdrawing from the calcareous lateral walls and shriveling to the bottom of the cup; utricles free on decalcification or but slightly and irregularly coherent; subcortical layer thin, the central filaments easily visible through the cortex after removal of the lime: filaments of the central strand coherent at the nodes, being there closely connected by

* Investigation aided by a grant from the John Strong Newberry Fund of the Council of the Scientific Alliance of New York.

[The BULLETIN for October (32: 515–561) was issued 21 O 1905.]

very short anastomosing processes. [PLATE 23, FIGURE 2; PLATE 24; PLATE 26, FIGURES 1–6.]

Near low-water mark in the Bahama Islands: *no. 3981*, type (Cave Cays, Exuma Chain, 19 February 1905, M. A. H.); *nos. 3417b* and *3421b* (Rose Island); *no. 4186a* (Stocking Island, Exuma Harbor).

Halimeda favulosa simulates in form, size and habit certain conditions of *H. tridens* (Ell. & Soland.) Lamour. or of *H. tridens Monile* (Ell. & Soland.) * but is easily and constantly distinguished by the very large peripheral utricles (110–260 μ *vs.* 33–68 μ in *H. tridens*) which, on drying, collapse or withdraw into the subtending and separating lime-cups, leaving the surface conspicuously and rather beautifully favulose. In the character of the peripheral utricles the species suggests *H. macrophysa* Ask., though its utricles are sometimes even larger than in that, according to the measurements given by Askenasy and by Barton, but it has the size, form, and node-characters of the *H. tridens* group instead of the *H. Tuna-H. macrophysa* alliance. It evidently bears a relation to *H. tridens* similar to that of *H. macrophysa* to *H. Tuna*. In case of three out of the four collection numbers cited above, *H. favulosa* was found growing in company with *H. tridens* or *H. tridens Monile* and resembling them so much in habit that the distinctive characters escaped observation at the time of gathering.

There is a possibility that *Halimeda favulosa* will prove to be *H. brevicaulis* Kütz., † described from the Bahamas, but the doubts in regard to this can probably never be resolved unless Kützing's specimen, which now seems to be lost, is found.‡ *H. brevicaulis*, according to Kützing's figure and brief description, might equally well be a form of the extremely variable *H. tridens*, which is more abundant in the same region. The short stipe of "*brevicaulis*" has no special significance, but the apparently flaccid habit and tapering branches, it must be admitted, are rather suggestive of *H. favulosa*. Yet flaccid, decumbent conditions of *H. tridens* occur. Kützing describes the stipe of *H. brevicaulis* as terete, while in all the specimens of *H. favulosa* that we have

---

* **Halimeda tridens Monile** (Ell. & Soland.)
Corallina Monile Ell. & Soland. Nat. Hist. Zooph. 110. *pl. 20. f. c.* 1786.

† Tab. Phyc. **8**: 11. *pl. 25. f. 2.* 1858.

‡ See "Addendum" on page 586.

seen it is much flattened and in all the branching is much more congested. Furthermore, it seems hardly probable that Kützing, doubtless studying a dried specimen, would have failed to notice the peculiar and striking favulosity of the surface if he had had before him the species described above. Kützing's figure of *Halimeda Monile* (*l. c. pl. 26. f. 1*) illustrates the habit of the moniliform condition of *H. favulosa* rather well.

Hauck (Hedwigia **25**: 168. 1886) has gone on record as having seen an authentic specimen of *H. brevicaulis*,* but neither in the herbarium of Hauck nor that of Kützing, both now owned by Mme. Weber-van Bosse, is such a specimen to be found. The species is unrepresented also in a set of cotypes sent by Kützing to Montagne and now preserved in the Muséum d'Histoire Naturelle at Paris.

The Ellis and Solander types of *Halimeda* are said also to have disappeared † but none of their figures and descriptions of West Indian forms is especially suggestive of *H. favulosa;* at least, such an application is not likely to be proved in absence of original specimens.

In *Halimeda favulosa*, the peripheral utricles and sometimes the filaments of the subcortical layer and of the central strand are now and then gorged with dense granular contents as shown in our FIGURE 4. We have found no evidence that such parts become detached, but for some reason a reserve food supply seems to be concentrated in them.

Avrainvillea levis sp. nov.

Olivaceous when living, on drying often slightly tinged with yellow or verging toward cinereous, or at the margins sometimes fuscous, caespitose or gregarious from a short, scarcely rhizomatous base: stipe 0.5–4 cm. long, flattened or subcylindrical, simple or occasionally dichotomous at base: flabellum varying from reniform-suborbicular with cordate base to cuneiform-obovate, 1–7 cm. broad, entire, erose, or sometimes lobed, thin and membranous or sometimes thicker and coriaceous, compact in texture with a smooth or slightly wrinkled surface, for the most part distinctly zonate, now and then tending to form serially superposed flabella at the margins of the zones: filaments of flabellum slender, tortuous, interwoven, usually lightly and irregularly torulose, rarely

* Printed "*multicaulis*" by Hauck through an evident *lapsus*, as shown by label on Comoro specimen cited.

† Barton, E. S. The Genus *Halimeda*. Siboga-Expeditie, Monographe **60**: 1, 2. 1901.

somewhat moniliform, mostly 6–24 μ in diameter; those of interior often a little larger (reaching 35 μ), more chlorophyllose and less tortuous: angle of dichotomy commonly acute (about 30°–45°), sometimes obtuse (reaching 120°). [PLATE 23, FIGURE 1; PLATE 23, FIGURES 8–10.]

In the Bahama Islands, near low-water mark, or when growing under a rock overhang sometimes exposed at low tide: *no. 3996*, type (Cave Cays, Exuma Chain, 19 February 1905, M.A.H.); *no. 3574* (Frozen Cay, Berry Islands); *no. 3966* (Shroud's Cay, Exuma Chain).

The above-described species, though here appearing under a new specific name attached to a new nomenclatorial type, is doubtless the same as the species described by Murray and Boodle (Jour. Bot. **27**: 70. 1889) under the designation "*A. sordida* Crn. excl. syn." But according to both the Philadelphia and the Vienna codes of nomenclature, the use of the name *Avrainvillea sordida* for this species cannot be justified unless perchance it can be shown to be identical with the species described from the Philippines by Montagne in 1844 as *Udotea sordida*. The combination "*A. sordida* (Mont.) Crn. mscr." apparently first appeared in print in Mazé and Schramm's Essai de Classification des Algues de la Guadeloupe (p. 89. 1870–'77) and is there based on quoted synonymy, the citation of Guadeloupe specimens under collection numbers, and the following description: "De couleur brune olivâtre à l'état de vie." Under these circumstances, when one excludes synonymy one excludes all that has technical value in publication, and the name *Avrainvillea sordida* Crn., if used at all, must be made to apply to Montagne's plant. Our species, if it is to be kept separate from its Eastern Hemisphere analogue, as at present we believe it should, deserves a distinctive name.

Avrainvillea levis has a smooth compact surface that suggests a *Udotea* at first sight, though its structure is clearly that of an *Avrainvillea*. The filaments of the flabellum, however, are not so uniform in character as is the case in the other West Indian species of the genus, the filaments of the surface being often more slender, more tortuous, and less chlorophyllose than those of the interior.

Avrainvillea levis, so far as our experience goes, is the most constant and most easily recognized of the West Indian forms of this puzzling genus. Our remaining specimens, representing at

the present time about thirty localities, can be arranged, though rather unsatisfactorily, in two groups, which for the present we are designating as *Avrainvillea nigricans* Decaisne and *A. Mazei* Murray & Boodle. *Avrainvillea longicaulis*, as described and figured by Murray and Boodle,* we are convinced cannot be considered specifically different from *A. nigricans*, as represented by the probable type of the latter species preserved in the herbarium of the Muséum d'Histoire Naturelle in Paris.

The type of *Avrainvillea nigricans* Decaisne is referred to in the following words in the place of original description:† "In Antillis (îles des Saintes propè la Guadeloupe).—Cl. d'Avrainville. (v. in Herb. Mus. Paris.)." In the herbarium of the Paris museum, there is at the present time no specimen of d'Avrainville's collecting bearing the name *Avrainvillea nigricans*, but there is a single specimen associated with a label inscribed in Decaisne's hand: "*Avrainvillea nigra* Dne. Iles des Saintes près la Guadeloupe. M. D'Avrainville. 1842," and as this agrees with the description published under the specific name *nigricans*, there can be no reasonable doubt that it is the true type of the species in question. This specimen has a single somewhat worn and broken flabellum supported by a stipe a trifle more than 1 cm. long springing from a subcylindrical rhizome 3.5 cm. long, which is continued beyond into what may have been the stipe of another flabellum; the flabellum proper has a length of 3.3 cm. and its original width was probably about the same; the filaments of the flabellum are moniliform, as originally described, and have a diameter of 44–55 μ. We can discover nothing beyond its smaller size to distinguish it from the *A. longicaulis* of Murray and Boodle. The original *Rhipilia longicaulis* of Kützing‡ "Ad Antillas (Herb. Sonder)" has not been found in the Kützing herbarium now owned by Madame Weber-van Bosse, and an inquiry in regard to it has been addressed to Melbourne, Australia, where the Sonder herbarium, cited by Kützing, is supposed to be.§ The plant needs further study. We have never seen filaments from a flabellum ending in slender hyaline hairs like those figured and described by Kützing.

* Jour. Bot. **27**: 70. *pl. 288. f. 1–5.* 1889.

† Ann. Sci. Nat. II. **18**: 108. 1842.

‡ Kütz. Tab. Phyc. **8**: 13. *pl. 28. f. 2.* 1858.

§ See "Addendum" on page 586.

Rhizoidal filaments often have such a character but Kützing states that the figured filament came "aus dem Phyllom."

Avrainvillea nigricans and *A. Mazei*, as we interpret them, are best distinguished by the character of the filaments of the flabellum, those of *A. nigricans* being moniliform and those of *A. Mazei* being cylindrical with an abrupt constriction at the base of each branch. The flabellum in *A. Mazei* tends to be more diffuse, fluffy, and irregular, and it is often greener. In three cases, we have found the two growing side by side and perfectly distinct in form, color, and in the microscopic characters of the threads, yet elsewhere specimens have sometimes been found which seem to hold a rather doubtful intermediate position. In one case (Bermuda, *no. 109*) filaments from two flabella springing from a single rhizome have different characters, those from the one being clearly of the *Mazei* type while those from the other make a close approach to the regularly moniliform condition of *A. nigricans*. The fact that *A. nigricans* and *A. Mazei* have been found wholly distinct when growing together under apparently the same conditions leads to the opinion that they should be considered separate species in spite of some present difficulties in the way of always recognizing them. Each of the two presents wide variations in form, size and color. What we believe to be a low-littoral or shallow-water condition of *Avrainvillea Mazei* forms greenish-brown, caespitose masses near low-water mark on exposed rocks, and has finger-shaped or round-capitate lobes, not developing a flabellum unless it descends a decimeter or more below the low-tide line. Among the forms that we are at present identifying with *A. nigricans*, one extreme is represented by plants with a suborbicular flabellum (reniform-cordate when young), reaching a width of 25 cm., supported by a cylindrical stipe, which has a maximum length, so far as observed, of 16 cm., this springing from a strongly developed rhizome; the other extreme has a cuneiform flabellum, sometimes no more than 1–2 cm. wide, tapering gradually to a flattened scarcely recognizable stipe, with rhizome poorly developed. Between these two extremes there seems to be a nearly perfect series of intermediates, but perhaps further familiarity with the genus, particularly with living specimens, will result in the recognition of some satisfactory basis for specific distinctions.

Cladocephalus gen. nov.

A genus of *Chlorophyceae* of the family *Codiaceae*. Thallus erect, consisting of capitulum and stipe, the latter attached to the substratum by matted rhizoids, all parts destitute of calcareous incrustation. Stipe and branches of the capitulum corticated, the medullary portion consisting of parallel, sparingly dichotomous chlorophyllose filaments, the cortical layer composed of much narrower, intricate, repeatedly divaricate-dichotomous filaments, which are finally deficient in chlorophyl. Capitulum thamnioid or scopiform, made up of numerous, irregularly dichotomous, non-zonate, often coherent or anastomosing branches. Mode of reproduction unknown.

The genus *Cladocephalus*, though having a slight superficial resemblance to *Penicillus* in habit and form, is most nearly allied to *Avrainvillea*, being in some respects intermediate between that genus and *Udotea*. It differs from both *Avrainvillea* and *Udotea* in having a thamnioid or scopiform capitulum instead of a flabellum; from *Avrainvillea* also in possessing a well-differentiated cortex; from *Udotea* also in the absence of zonation and from its corticated species in the intricate, labyrinthiform character of the cortex, which is made up of more regularly dichotomous, less pectinate filaments. *Cladocephalus* is doubtless as distinct from *Avrainvillea* as *Avrainvillea* is from *Udotea* and more so than *Rhipocephalus* is from *Penicillus*.* The genus, so far as known to the writer, is monotypic, the only species being

Cladocephalus scoparius sp. nov.

Very dark green or nigrescent when living, commonly becoming yellowish-brown, substramineous, or olivaceous on drying, solitary or gregarious, 5–14 cm. high; rhizoids forming a somewhat bulbous mass: stipe 2–10 cm. high, 3–7 mm. thick, subcylindrical or somewhat complanate, often alate or canaliculate above, simple or occasionally once or twice dichotomous, the branches sometimes again connate: capitulum scopiform, varying in outline from elongate-fusiform or elongate-ellipsoid to obovoid or subspherical, often somewhat flattened, 3–8 cm. long; branches subcylindrical or complanate, 0.3–2 mm. broad, frequently connate at points of casual contact, now and then subdenticulate near

* *Codiophyllum* J. E. Gray, judging from the author's description and figures (Ann. & Mag. Nat. Hist. IV. **10**: 139–141. *pl.* 9. 1872), is very different in structure, if indeed it is really a plant.

apices: filaments more or less fuscous in the older parts, sometimes bright-green in the younger; filaments of the cortex labyrinthine, lightly torulose when young, the ultimate branches in older parts 6–11 μ in diameter, finally subhyaline; filaments of medulla cylindrical or lightly and irregularly torulose, 30–75 μ in diameter, slightly or not at all constricted just above a dichotomy, covered by cortex at apices or rarely protruding: stipe similar to the capitulum in structure, its cortex a little thicker and firmer. [PLATE 25; PLATE 26, FIGURES 11–20.]

Rare and local in the Bahama Islands, on sandy or muddy bottom in 2–10 dm. of water (low tide): *no. 4079*, type (in a tidal pond, Georgetown, Great Exuma, 24 February 1905, M.A.H.); *no. 3081* (south shore of New Providence, 10 April 1904 — a single specimen).

Besides the single specimen collected on the shores of New Providence, we have thus far met with this remarkable plant on only one occasion, when several hundreds were found growing associated with two species of *Penicillus* in a small area in an inland pond which had been connected with the sea by an artificial canal. They seemed here to be in all stages of development, but unfortunately we have been unable to find in them anything that could be taken with confidence to be reproductive bodies. There are often, lying on and among the threads of the cortex, ovoid or subglobose bodies 40–50 μ in diameter, with densely granular contents, much resembling the supposed reproductive bodies figured by Kützing* for his *Rhipozonium lacinulatum* (*Udotea Desfontainii*); but these seem to be always free and unattached, their contents are of a little different green, and we believe that they represent an independent organism.

While the plant is uncalcified in the ordinary sense of the term, the stipe or its base is commonly infiltrated with multitudes of minute crystals which lie free in irregular clusters among the filaments, particularly of the cortex. When a piece of the stipe is dissected in a drop of water they often wash out in such numbers as to give a milky appearance to the water. The crystals dissolve with the evolution of gas on the application of acetic acid and are taken to be calcium carbonate.

The cortex is formed by branches originating subdichoto-

* Phyc. Gen. *pl. 42. III. f. 2.* 1843.

mously from the more peripheral members of the medullary strand and becoming afterwards apparently lateral. These branches then undergo repeated divaricate forkings with a gradual diminution of diameter until finally they may have only one-fifth or even one-twelfth the diameter of the filaments of the central strand.

B. NEW RHODOPHYCEAE

Sarcomenia filamentosa sp. nov.

Rose-red on drying or sometimes brownish-red, very delicate, gelatinous, gregarious or caespitose-pulvinate on other algae, 4–16 cm. long, pseudodichotomous below; main axes distinctly corticated for one-half to four-fifths the length of the plant, subcylindrical or complanate, ancipitous, 0.25–0.9 mm. in diameter near base, bearing occasional divaricate, rather rigid, simple or dichotomous septate rhizoids on the opposite lateral margins: cells of cortex polymorphous, ranging from orbicular and triangular-ovate to oblong and linear, toward base sometimes 12–16 times as long as broad: main branches dissolving above in numerous narrowly linear or ribbon-shaped articulate uncorticated branchlets 50–170 μ wide, these springing from the mid-ventral * line of the next older branch, their segments $\frac{2}{3}$–1 $\frac{1}{2}$ times as long as broad, consisting of four pericentral siphons and a pair of short cortical (?) siphons arranged end to end on each lateral margin, occasional marginal cells enlarged and more or less protuberant (potentially rhizoids); cross-sections of branchlets about twice as broad as high, showing a distinct costa, this especially prominent ventrally; branchlets furnished toward their apices with a secund mid-ventral row of unbranched monosiphonous filaments, these 0.2–1 mm. long, originating singly from a cell cut off from the anterior end of the ventral siphon of each segment, deciduous in older parts, cells of filament 7–20 in number, mostly 2–6 times as long as broad: reproductive organs unknown. [PLATE 27; PLATE 29, FIGURES 1–11].

On *Sargassum*, corallines, etc., washed ashore. Florida: *no. 2844*, type (Cape Florida, Biscayne Key, 29 March 1904, M.A.H.—also *nos. 2860* and *2865*); *no. 2822* (Virginia Key, 22 March 1904).

* We use "dorsal" and "ventral" in the sense in which these terms are employed by J. Agardh (Anal. Alg. Cont. 5: 122–149. 1899) in apparent conformity with the customary usage as applied to leaves of cormophytes, the "ventral" being the "inner" or "upper" side. However, a comparison with creeping species of the superficially somewhat similar genus *Herposiphonia* suggests the possibility that these terms, if used at all, should be applied in the reverse sense.

Sarcomenia filamentosa does not appear to be very closely related to any of the described species of this chiefly Australian genus. The only other species to which monosiphonous filaments are attributed are, so far as we can discover, the Australian *Sarcomenia tenera* (Harv.) J. Ag., *S. dolichocystidea* J. Ag., *S. opposita* J. Ag. and *S. secundata* J. Ag., but these are all much coarser plants with Dasyoid or Cliftonioid rather than Polysiphonioid habit, and the origin and arrangement of the branchlets and monosiphonous filaments are more or less different in all of these. In its delicate Polysiphonioid habit, *S. filamentosa* is nearer the group which includes *S. miniata* (Ag.) J. Ag. (the type of which we have seen in hb. Agardh), *S. intermedia* Grunow, and *S. mutabilis* (Harv.) J. Ag., but these differ not only in absence of monosiphonous filaments, but also in cortex characters, etc.; in *S. mutabilis*, also, the branches have a marginal or submarginal instead of mid-ventral origin.

The apparent incongruity of referring delicate plants of the *miniata* type to a genus originally based upon the fleshy membranous *Sarcomenia delesserioides* has already been remarked by Grunow * and discussed at length by J. Agardh.† In placing the above-described new species in *Sarcomenia*, we accept, for the present, the current conception of the limits of the genus.

The plant changes color and partially decomposes very soon after being collected, even though placed in a moderate amount of sea-water. It adheres most firmly to paper on drying yet recovers its form well on being soaked out if the material was originally good and properly prepared.

Dudresnaya crassa sp. nov.

Rose-colored when living, dingy-purple or brownish-red on drying, densely ramose, lubricous, subpyramidal in contour, 6–8 cm. high, the primary branches appearing irregularly 1–2-pinnate when pressed on paper, the secondary and tertiary branches then mostly confluent, unequal in length, vermiform, apices obtuse; branches of all orders of nearly uniform diameter throughout, 1–2 mm. thick in natural state, 1.5–3 mm. after pressure, all parts very closely adherent to paper: monosiphonous axis much

* Reise seiner Majestät Fregatte Novara um die Erde. Bot. Theil 1: 93. 1867.
† Anal. Alg. Cont. 5: 130. 1899.

obscured by the very numerous decurrent filaments, its cells 2–8 times longer than broad; peripheral filaments 4–6 times dichotomous, beautifully fastigiate, 0.5–0.8 mm. long, scarcely constricted at the joints, 5–6 μ in diameter, the more peripheral cells 2–5 times as long as broad: carpogonial branch simple, consisting of 5–19 subspherical or somewhat discoid cells in a single series, its apex slightly deflexed and terminating in the much elongated, curved or nearly straight trichogyne; auxiliary-cell branches numerous, consisting of 5–9 enlarged subspherical or oblate-ellipsoidal cells near base, terminating in a multiarticulate prolongation similar to that of the other peripheral filaments or often shorter; auxiliary-cell occupying the middle of the enlarged portion of the branch and having little more than half the diameter of the two immediately adjacent cells, the latter much inflated, rich in contents, 15–30 μ in transverse diameter: cystocarps 0.12–0.24 mm. in diameter, often 2–4-lobed: antheridia and tetrasporangia unknown. [PLATE 28; PLATE 29, FIGURES 12–26.]

On rocks in 3 m. of water (low tide), Castle Harbor, Bermuda: *no. 315*, type (6 July 1900, M. A. H.); also a floating fragment at Spanish Point, Bermuda, *no. 198*.

Dudresnaya crassa is nearest allied to *D. coccinea* (Ag.) Crouan in the structure of the carpogonial branch and the auxiliary-cell apparatus and in the elongated cells of the peripheral filaments, but is very different in size and habit, in the obtuse ultimate branches which have nearly the diameter of the primary, in having its peripheral filaments 2–4 times as long as in *D. coccinea*, and in the highly specialized auxiliary-cell, which is always much smaller than the conspicuously enlarged adjacent cells. Thuret states* that in *D. coccinea* the branches which bear the antheridia occur on the same plants that bear the cystocarps; in *D. crassa*, the antheridia have been searched for in vain on the cystocarpic individuals — the only sort collected — and the species is believed to be dioicous. In its dense habit of branching, the species bears a closer superficial resemblance to *D. purpurifera* J. Ag., though the branches are obtuse and coarser; however, in structure of the carpogonial branch and the auxiliary-cell apparatus† and in the character of the peripheral filaments, it differs so widely that no detailed comparison is necessary.

* Bornet & Thuret, Notes Algologiques, 36. 1876.

† See Oltmanns, Morphologie und Biologie der Algen 1: 688–691. *f. 441a, 441.* 1904.

The only specimen from the American side of the Atlantic which has heretofore been referred to the genus *Dudresnaya* is, so far as we know, one collected in the Tortugas, Florida, by Mrs. G. A. Hall and described as new by J. Agardh in 1899 under the name "*Dudresnaja canescens*" (Anal. Alg. Cont. **5**: 88). This, however, is a plant of entirely different habit from ours and is not a *Dudresnaya*, as a recent examination of the single type-specimen in hb. Agardh has shown.

The auxiliary-cell branches and cystocarps are very abundant in our material and we have been able to observe nearly all stages in their development and mutual relations, though without any serious attempt to study the internal cytological changes. In their general features, the fusion of the sporogenous filament and the auxiliary-cell and the subsequent development of the cystocarp take place very much as described and figured for *D. coccinea* by Bornet and Thuret and by Oltmanns. However, Thuret's description (*l. c.*) gives the impression that the fusion can take place with any one of three similarly enlarged cells of the auxiliary branch, while in *D. crassa* it seems always to occur with a single definite highly specialized cell lying between the two larger ones. The content of this cell appears at first very much like that of the adjacent cells, but as it matures it undergoes a change, becoming more homogeneous and translucent; at the same time the auxiliary-cell and the two neighboring cells become enveloped in an especially thick layer of mucus which stains yellowish with safranin. We regret that the behavior of the carpogonial branch after fertilization has escaped observation in this species. Carpogonia occur in moderate number in our material (we have seen 25 or 30), but all seemed unfertilized; and the sporogenous filaments travel such long distances that we have failed in attempts to trace them back to their ultimate source.

The type-specimen — *no. 315* — is associated with a *Chantransia*, which permeates it, more or less, and fringes its surface.

C. MISCELLANEOUS NOTES

CAULERPA CRASSIFOLIA (Ag.) J. Ag. Till Alg. Syst. **1**: 13. 1872

Caulerpa taxifolia β crassifolia Ag. Sp. Alg. **1**: 436. 1822. (Excluding synonymy.)

Caulerpa pinnata Web.-v. Bosse, Ann. Jard. Bot. Buitenzorg **15**: 289. 1898. Not *Fucus pinnatus* L. fil. Suppl. 452. 1781.

Under the name *Fucus pinnatus* * in the Linnaean herbarium, now in possession of the Linnean Society of London, is a single sheet of four or five fragmentary specimens which agree with the somewhat detailed original description sufficiently well to leave no reasonable doubt that they represent the type material of that species. The natural form of the plant is somewhat modified by drying and pressure, yet it is evident that the pinnules are cylindrical (or clavate), as afterwards figured and described by Turner (Hist. Fuc. **1**: 117. *pl. 53.*) and that the plant belongs in the section *Sedoideae* (J. Ag.) of *Caulerpa*, being close to *C. racemosa corynephora* (Mont.) Web.-v. Bosse.† In the younger parts of the specimens the pinnules are distinctly inflated at their apices and are less regularly distichous; it is probable that this character suggested the Linnaean words which puzzled Turner: "Inflorescentia est racemus ex verticillis cum fructificationibus pedicellatis, peltatis, planis."

Madame Weber in her scholarly "Monographie des Caulerpes" refers to an authentic specimen of the *Fucus pinnatus* of Turner in the herbarium of the British Museum. This specimen of Turner's we have not seen, but if it belongs to the Filicoid rather than the Sedoid group, the apparent disagreement with Turner's description and figure should suggest doubts as to its authenticity or suggest the possibility that Turner's material was mixed. In any event, the true type of *Fucus pinnatus* L. fil. should be sought in the Linnaean herbarium rather than in that of the British Museum.

In the Agardh herbarium at Lund are two specimens which, judging from the original citation, probably served as originals of the "*Caulerpa taxifolia β crassifolia.*" Of these only one is actually associated with the name *crassifolia;* this is a fragment in a pocket inscribed "Caul. taxifolia var. crassifolia Ag. e mari Antillarum mis. Sprengel." This is suggestive of the familiar figure of *C. crassifolia* given in the Pflanzenfamilien of Engler and Prantl,

* Mr. B. Daydon Jackson informs me that the handwriting is that of the younger Linnaeus, whom he considers to be the real author of the "Supplementum."

† Ann. Jard. Bot. Buitenzorg **15**: 360, 364. *pl. 33. f. 10–13.* 1898.

and attributed to Sachs, except that the pinnules are scarcely narrowed at the base and are of course flatter than indicated in that figure. The second specimen — which is of the same species — is marked "Fucus taxifolius Vahl variet. C. M. 1821. ex Ind. occ." The "In mari Indico & rubro" habitat, also cited by C. Agardh in his original publication of "*β crassifolia*" was evidently derived from the erroneously identified *Fucus pinnatus* of Linnaeus fil. and of Turner, which he cites as a synonym. J. Agardh apparently had become suspicious of the alleged synonymy, for (Till Alg. Syst. **1**: 14) he remarks, "utrum synonyma ibidem allata * * * ad eandem pertineant, dicere non auderem."

Caulerpa sertularioides (S. G. Gmel.)

Fucus sertularioides S. G. Gmel. Hist. Fuc. 151. *pl. 15. f. 4.* 1768.

Fucus plumaris Forsk. Fl. Aegypt.-Arab. 190. 1775.

Caulerpa plumaris Ag. Sp. Alg. **1**: 436. 1822. — J. Ag. Till Alg. Syst. **1**: 15. 1872. — Web.-v. Bosse, Ann. Jard. Bot. Buitenzorg **15**: 294. 1898.

That Gmelin's *Fucus sertularioides* is the same as the plant commonly known as *Caulerpa plumaris* is admitted by J. Agardh and, more recently, by Madame Weber-van Bosse. Gmelin's figure and description seem sufficiently conclusive; his plant was American ("in corallis americanis"), though no definite locality is given. The rulings of the recent International Botanical Congress at Vienna, though professedly applying only to the spermatophytes and pteridophytes, are explicit as to the maintenance of the oldest specific name.

Acetabulum Farlowii (Solms)

Acetabularia Farlowii Solms, Trans. Linn. Soc. Bot. II. **5**: 27. *pl. 3. f. 1.* 1895.

This species was founded upon three somewhat imperfect plants sent by Farlow to Thuret. In the place of publication the material is said to have come from the "southern point of Florida, Key West," but Professor Farlow writes us that the alga was collected in Biscayne Bay, Florida, by Dr. E. Palmer in 1874. At the close of the original description, which was necessarily brief

from lack of material, Count Solms expresses the hope "that this remarkable plant will be found again soon."

On November 11, 1902, the writer found on the northeastern shore of the island of Key West, a considerable quantity of a handsome little *Acetabulum* growing attached to shells, stones, broken pieces of coral, etc., at just about the low-water line and rather closely confined to this zone. Adjacent, in water that was from 1 to 10 dm. deep at low tide, and occasionally approaching and intermingling with the lower-growing individuals of this small green *Acetabulum*, were numerous clusters of the larger, whiter, more rigid, and more strongly calcified *Acetabulum crenulatum* (Lamour.) Kuntze. A hand-lens showed the strong cusp or apiculum with which each ray of the disc in *A. crenulatum* always terminates in in the younger stages at least, while the rays in the smaller species appeared to be entirely destitute of an apiculum even in the youngest conditions that could be observed at the time. Confident that two species were represented by the specimens growing at this point and finding on returning to New York that the smaller plant evidently had much in common with the *Acetabularia Farlowii* as described and figured by Solms, we submitted specimens of it both to Count Solms and Professor Farlow, both of whom approved the reference to *A. Farlowii*, though with a certain amount of cautious reserve in view of the scantiness of the original material.

In March 1904, the writer again found *Acetabulum Farlowii* in abundance, this time at Miami, Florida, and at Cutler, both on Biscayne Bay. Here again, the *A. Farlowii* was confined to a rather narrow zone near the low-water mark, while *A. crenulatum* (which in Biscayne Bay is more profusely abundant than we have yet seen it elsewhere), with a wider range, had its best development in deeper water (best in 3 dm. to 4 m., low tide). The zones occupied by the two species occasionally, however, overlapped; the individuals intermingling in this common region were, as a rule, easily referred at sight to the one species or the other, though once in a while an individual was met with whose affinities seemed at first a little dubious. Yet we believe that the two are actually and always distinct and distinguishable and that the principal diagnostic characters may be contrasted as follows:

Acetabulum crenulatum	*Acetabulum Farlowii*
Discs usually well-calcified and whitish on drying, often 2 or 3 superposed, commonly infundibuliform or cyathiform, 5–15 mm. broad; sporangia (rays) mostly 35–60, persistently coherent, strongly apiculate in early stages, the apiculum sometimes obscure with age; aplanospores 200–500 to a sporangium.	Discs lightly calcified, green on drying, solitary, nearly plane, 4–7.5 mm. broad; sporangia (rays) mostly 20–30, lightly coherent or often separate and free, rounded-obtuse or truncate at apex from an extremely early stage; aplanospores 40–120 to a sporangium.

The feature in which, chiefly, the original description given by Solms needs amendment is in regard to the coherence of the rays. *A. Farlowii* was placed by Solms in a group with *A. Calyculus* under the caption "Rays even in the living state separate and free." An examination of some thousands of individuals in the living state leads us to the opinion that only about one in four or one in five has the rays separate and free. However, clusters of plants are found in which the rays of nearly every disc are discrete; other clusters in which the rays nearly always remain coherent, forming discs that are slightly concave or almost plane. In some cases, the rays are apparently discrete from the first; in others, they have probably become more or less separated by mechanical agencies.

Specimens of *Acetabulum Farlowii* obtained by the writer at Key West under the collection number *1676* were distributed in the Phycotheca Boreali-Americana as *no. 1032*. We have not met with the species in the Bahama Islands; so far as known, it is confined to southern Florida.

BATOPHORA OERSTEDI J. Ag. Öfvers. Kongl. Vet.-Akad. Förh. **11**: 108. 1854.

Dasycladus Conquerantii Crouan; Schramm & Mazé, Essai Classif. Alg. Guadeloupe, 47. 1865. — Mazé & Schramm, Essai Classif. Alg. Guadeloupe, 108. 1870–77. [According to specimens in hb. Mus. Paris., and hb. Mus. Brit., distributed by Mazé and by Mazé & Schramm.]

Botryophora Conquerantii Cramer, Neue Denkschr. Schweiz. Naturf. Ges. **32**: 6. *pl. 4. f. 1.* 1890.

Coccocladus occidentalis Conquerantii M. A. Howe, Bull. Torrey Club **31**: 96. 1904.

Coccocladus occidentalis laxus M. A. Howe, *l. c.* 95. *pl. 6. f. 1, 2.*

Batophora Oerstedi occidentalis (Harv.)

Dasycladus occidentalis Harv. Ner. Bor.-Am. **3**: 38. *pl. 41B.* 1858.

Botryophora occidentalis J. Ag. Till Alg. Syst. **5**: 141. 1887.

Coccocladus occidentalis Cramer, Neue Denkschr. Schweiz. Naturf. Ges. **30**: — (37). 1887.

The discovery that *Batophora Oerstedi* was published by J. Agardh four years previously to Harvey's *Dasycladus occidentalis*, and that it was apparently forgotten even by J. Agardh himself, is a good illustration of the surprises which must now and then await any one who is partial to the cause of priority in botanical nomenclature. In 1854 J. Agardh published a very full description both of "*Batophora*, J. Ag. mscr. Gen. nov. ex Siphonearum familia inter Oliviam et Dasycladum intermedium" (*l. c.* 107) and of its single species, *Batophora Oerstedi*, "Hab. ad radices Rhizophorae Mangle in sinu substagnante 'Krauses lagoon' dicto, ad Insulam St. Crucis: Oersted." In 1887, in publishing "Botryophora J. Ag. mscr.," he alludes to his already having designated the plant *Botryophora Oerstedi* in a collection of algae made by Oersted, even before Harvey published *Dasycladus occidentalis*, but there is no reference to his having already actually printed a description of the proposed new genus under a somewhat different generic name and this fact appears to have been overlooked, so far as we can discover, by all subsequent phycologists and bibliographers. If any evidence were needed that this omission on the part of Agardh was due simply to a lapse of memory and not to any intent to ignore, it would be furnished by his attitude toward certain other species and names published in the same paper.*

Possibly it may be objected that "Batophora" is a misprint for the "Botryophora" of thirty-three years later. To this it may be replied that "Batophora" is well formed etymologically, is fully

* *E. g.*, *Bryopsis Duchassaingii* J. Ag. Öfvers. Kongl. Vet.-Akad. Förh. **11**: 107. 1854. — "Hoc nusquam a me publici juris factum, jamdudum oblitum credidissem" (Till Alg. Syst. **5**: 31. 1887).

as significant and appropriate as "Botryophora," and in the Agardh herbarium the name *Batophora Oerstedi* appears in connection with one of Oersted's specimens.

In the Agardh herbarium are several small sheets of specimens which probably served as the original materials of *Batophora Oerstedi*. Three of these are fastened to a larger sheet; the others are loose in another cover with a loose label. Only one (one of the fastened sheets) has an individual inscription and this is inscribed simply "*Batophora Oerstedi*." The specimens illustrate the condition of the species which is found in quiet and often merely brackish water — a condition characterized by large size, lax habit, and obovoid or oblong-ellipsoidal sporangia, which occur at the ends of the branches of the first three orders. *Coccocladus occidentalis laxus* M. A. Howe is a form that is very common in the Bahama Islands, growing in interior ponds of which the nearly fresh water responds only slightly to the changes of the tides — often associated in about equal abundance with *Chara Hornemanni* and *Ruppia maritima*. Since seeing authentic material of *Batophora Oerstedi* and *Dasycladus Conquerantii* and since studying these plants in the living condition on two visits to the Bahamas, we hardly think it worth while to maintain the subspecific name *laxa*. The contrast in size and habit and in form and position of sporangia, between the lax plants of the interior brackish ponds and the condensed ones of the border of the open ocean (here placed under the subspecific name *occidentalis*) is remarkably striking, yet the peculiarities of each, we believe, are directly connected with the degree of salinity and quietness of the water. Intermediate forms occur in places of intermediate character.

NEOMERIS COKERI M. A. Howe, Bull. Torrey Club **31**: 97. *pl. 6. f. 3–12.* 1904

This strongly marked species, described from material collected by Professor Coker in 1903, on the island of Eleuthera, Bahamas, is not uncommon throughout the Bahamian archipelago, ranging at least from the Great Bahama on the north to the Great Exuma on the south. Its usual habitat is under shelving rocks near the low-water line. The original description was based on rather small individuals having a length or height of 7–14 mm.

A maximum height of 37 mm. has since been observed and the spores are sometimes oblong-ellipsoidal instead of obovoid.

FUCUS SPIRALIS L. Sp. Pl. 1159. 1753

The above name has now and then since the time of Linnaeus been applied by European writers to certain forms of North European rockweeds representing doubtless two species, the one always synoicous, the other a condition of the always dioicous *F. vesiculosus*. In America, the name has had little vogue, except as used by Farlow * and others for a variety of *F. vesiculosus*, without citation of Linnaeus. In 1883, Kjellman in "The Algae of the Arctic Sea" † definitely recognized *Fucus spiralis* L. as a species, though in 1890 ‡ he renamed the species *Fucus Areschougii* Kjellm., having apparently become doubtful as to the identity of the Linnaean plant. De-Toni §, however, a little later, quotes *F. Areschougii* as a synonym of *F. spiralis* L. without any indications of doubt, and more recently Börgesen ‖ has given a detailed discussion of the subject, in which he considers not only *F. Areschougii* Kjellm. but also *F. platycarpus* Thuret to be synonyms of *F. spiralis* L. Börgesen's determination of *Fucus spiralis* rests chiefly on the Linnaean descriptions. As is well known, the comparatively modern idea of nomenclatorial type-specimens was not recognized by Linnaeus, and the herbarium that he left is not always satisfactory or conclusive to the one who would see the materials that he actually had before him in writing his descriptions. Nevertheless, the specimens in the Linnaean herbarium to which we may believe Linnaeus himself attached the name *spiralis* are of much interest in this connection and it may be said that they seem to support Börgesen's position. There are under this name in the Linnaean herbarium, which we were permitted to examine through the courtesy of Mr. B. Daydon Jackson, two specimens fastened to separate sheets, each inscribed at the bottom "4 spiralis" in Linnaeus' hand. Both specimens are fertile and both are without vesicles. The wholly justifiable restrictions placed

* Mar. Alg. N. E. 101. 1881. — Farl. And. & Eat. Alg. Exsic. Am. Bor. *109 bis.*

† Kongl. Sv. Vet.-Akad. Handl. **20**[5]: 202.

‡ Handb. Skand. Hafsalgflora, 11.

§ Syll. Alg. **3**: 207. 1895.

‖ Mar. Alg. Faeröes, 472–477. 1902.

upon the use of this historic collection did not permit any attempts to determine whether the plants are synoicous or dioicous, but one, at least, of the two, is, in our opinion, very clearly a rather small specimen of the typical *Fucus Areschougii* Kjellm. This specimen is 10 cm. high, the branches are somewhat contorted and 4–6 mm. broad above, the distinct costa alone persisting in most of the lower half; the receptacles are ovate, obovate or suborbicular, and 5–8 mm. long. It evidently represents a form of the synoicous species which on the eastern coast of North America is common from Maine to Newfoundland and doubtless ranges farther north; it is confined to a rather narrow zone near the high-water mark. Specimens illustrating this form from Cape Rosier, Maine, were issued as *no. 234* of the Phycotheca Boreali-Americana of Collins, Holden & Setchell under the name *Fucus Areschougii* Kjellm. The other Linnaean specimen cannot be so confidently determined without dissection, yet we have little doubt that it also represents a condition of the same synoicous species. This is a larger, uncontorted plant, with more elongated receptacles and more conspicuous cryptostomata, and the wings are more persistent below; it is about 20 cm. high, the even-topped branches are 4–8 mm. wide, the verrucose receptacles are 8–20 mm. long, mostly 2–3 times as long as wide, though one or two are suborbicular. This appears to exemplify a form of the species which in North America is rather more southern in its range than the other, being not uncommon near the high-tide line in Long Island Sound within the limits of New York City. This more southern form occasionally approaches *Fucus platycarpus* Thuret in habit, and specimens from Marblehead Neck, Massachusetts, were distributed under that name in the Phycotheca Boreali-Americana, *no. 1132*; however, we have seen no American specimens in which the receptacles are as pronouncedly lateral as in the typical *F. platycarpus* of northern France. The larger forms of *Fucus spiralis* are sometimes imitated by certain evesiculose conditions of *F. vesiculosus*, but can be distinguished by being always synoicous and usually also at sight by having more strongly verrucose and more margined receptacles. It grows typically in a higher zone on the rocks than does *F. vesiculosus*. Vesicular inflations are occasionally present, but they are much elongated and irregular in form and position.

It is of interest to add that the writer has sent photographs of the two Linnaean specimens of *Fucus spiralis* to Dr. Börgesen, who writes: "One of them is a true *Fucus spiralis* (= *F. Areschougii* Kjellm.), the other is a little dubious, it may be *Fucus spiralis*, but it also very well may be a form of *Fucus inflatus*."

FUCUS POITEI Lamour. Diss. 63. *pl. 31. f. 2, 3.* 1805

That the *Fucus Poitei* of Lamouroux was a *Laurencia* seems to have been suspected first by the keen-eyed Kützing.* J. Agardh, a little later, judging, as would appear from his discussion, only from Lamouroux's description and figures (and possibly somewhat influenced by the fact that Lamouroux in 1813 placed the plant in *Chondrus* instead of in *Laurencia*), referred this *Fucus Poitei* to the very different genus *Gracilaria* and expressed his confidence in the correctness of this determination by writing an exclamation mark after the citation. Since that time, so far as we can discover, this determination has not been questioned and "*Gracilaria Poitei* (Lamour.) J. Ag." has held a place in general monographs and in special papers relating to West Indian algae.

In the herbarium of Lamouroux at Caen, which we had the privilege of seeing in the summer of 1904 through the courtesy of Professor Octave Lignier, there are in the cover devoted to this species a single small mounted specimen (4 cm. high, 6.5 cm. broad), two loose fragments, a loose slip of paper inscribed "fucus poitei" in the handwriting of Lamouroux, and two drawings marked "fig. 3" and "fig. 4me." Fig. 3 was published as *f. 2*; fig. 4me as *f. 3*. The specimens, which Lamouroux's good diagnosis and rather poor figures allow us to assume, with much confidence, to be parts of the original, belong to the genus *Laurencia* and to the common West Indian species described by J. Agardh under the name *L. tuberculosa*† and afterwards figured and described by Kützing as *L. mexicana*.‡

NEW YORK BOTANICAL GARDEN.

* Species Algarum, 857. 1849.

† Sp. Alg. **2**: 760. 1852.

‡ Tab. Phyc. **15**: 25. *pl. 70. f. c. d.* 1865.

Explanation of plates 23-29

PLATE 23

1. *Avrainvillea levis.* Photograph of two dried specimens(*no. 3996*, type —, Cave Cays, Exuma Chain, Bahamas, 19 F 1905, M. A. H.), natural size.

2. *Halimeda favulosa.* Photograph of about one half of one segment of a dried specimen (from *no. 3981*, type), magnified sixteen diameters.

PLATE 24. *Halimeda favulosa*

Photograph of dried specimen (*no. 3981*, type —, Cave Cays, Exuma Chain, Bahamas, 19 F 1905, M. A. H.), reduced to about two-thirds the natural dimensions.

PLATE 25. *Cladocephalus scoparius*

Photograph of formalin-preserved specimens (*no. 4079*, type —, Georgetown. Great Exuma, Bahamas, 24 F 1905, M. A. H.), natural size. The young plant at the right with the truncate apex shows only the beginning of the differentiation of the capitulum; the other two short plants represent later, though still very immature, stages in the development of the capitulum — in one the stipe is furcate above, the two branches again coalescing; the three largest specimens are typical full-grown plants.

PLATE 26

1–6. *Halimeda favulosa*

1–3. Peripheral utricles, decalcified, in lateral view.

4. Peripheral utricles with dense granular content (see page 565).

5. Peripheral utricles in surface view, decalcified.

6. Filaments of the central strand, showing mode of union at the nodes.

Figures 1–6 are all enlarged 40 diameters and are all drawn from the type material, *no. 3981* (Cave Cays, Exuma Chain, Bahamas).

7. *Halimeda tridens*

7. Peripheral utricles, decalcified, in lateral view, × 40. Introduced for comparison with *H. favulosa*.

8–10. *Avrainvillea levis*

8. One of the larger filaments from the flabellum, with dichotomy.

9. A filament of the usual size, from flabellum.

10. A filament from apical margin of flabellum, with wide-angled dichotomy.

Figures 8–10 are all enlarged 150 diameters; 8 and 9 are drawn from the type material, *no. 3996* (Cave Cays, Exuma Chain, Bahamas); 10, from *no. 3966*.

11–20. *Cladocephalus scoparius*

11. One of the main branches of the capitulum, showing ramification, natural size. The left-hand side was toward the middle of the capitulum.

12. A detail of the branching of the capitulum, showing anastomoses, × 2.

13. Cross-sections of branches of the capitulum, × 4.

14. Fragment of a branch of the capitulum in surface view with part of cortex removed, disclosing medullary filaments, × 55.

15. Medullary filament from apex of capitulum, × 55. The branch at the left, now becoming lateral, represents the beginning of the cortical system.

16. The branch at the right represents a later stage in the development of the cortex, × 55.

17. Cross-section of stipe, × 4.

18. Cortical region of stipe in cross-section, × 150. Drawn from a microtome section 20 μ in thickness.

19. A stage in the differentiation of the cortical filaments later than that shown in figure 16, × 55.

20. Final form of cortical filaments of capitulum, × 150.

Figures 11–20 are drawn from formalin-preserved material of the type, *no. 4079* (Georgetown, Great Exuma, Bahamas).

PLATE 27. *Sarcomenia filamentosa*

Photograph of dried specimen (*no. 2844*, type —, Cape Florida, 29 Mr 1904, M. A. H.) attached to *Sargassum*, natural size.

PLATE 28. *Dudresnaya crassa*

Photograph of dried specimen (*no. 315*, type —, Castle Harbor, Bermuda, 6 Jl 1900, M. A. H.), natural size.

PLATE 29

1–11. *Sarcomenia filamentosa*

1. Apex of polysiphonous branchlet, ventral view, showing apical cell and origin of the paired marginal cells and of the monosiphonous filaments, × 193.

2. Older part of branchlet, dorsal view, × 193.

3 and 4. Cross sections of uncorticated branchlets, ventral side downward, × 193.

5. Apical portion of uncorticated branchlet, with the unifarious monosiphonous filaments, × 48.

6. Branchlet viewed from margin, showing bases of the monosiphonous filaments, × 193.

7. Part of an older branch, ventral view, showing origin of polysiphonous branchlet (really from axial siphon), × 44. Marginal cells at somewhat regular intervals are enlarged and protuberant (potentially rhizoids). The monosiphonous filaments have here disappeared, but the cell cut off from the anterior end of the ventral siphon marks their former position in each thallus-segment. Small intercalary cells, originating chiefly from the pericentral siphons, constitute the beginning of the cortex.

8. A similar branch, dorsal view, × 44. The rhizoids are here growing out.

9. Surface view near the base of one of the largest stems seen, showing cortical cells, × 40.

10. Cross-section of a similar main stem × 44.

11. Cross-section of an ordinary main axis in the basal third of the plant, × 44.

Figures 9 and 10 are drawn from our *no. 2860*; figures 1–9, and 11 are from the type material, *no. 2844* (Cape Florida).

12–26. *Dudresnaya crassa*

12. Outer portion of peripheral filament.

13–15. Carpogonial branches.

16 and 17. Auxiliary-cell branches; auxiliary-cell occupying middle of enlarged portion, lying between two much larger cells.

18–22. Fusion of sporogenous filament with auxiliary-cells; in figure 21, two cells (indicated by dotted lines) appear in the position formerly occupied by the auxiliary-cells; in figure 22, three cells occupy this position — the protruding one at the left will form the main body of the cystocarp or one lobe of it.

23–26. Cystocarps, showing relation to original auxiliary-cell branch and to the sporogenous filaments. The small peduncled cystocarp, developed at some distance from the original auxiliary-cell, shown in figure 26, is abnormal. Figures 24 and 25 show mature cystocarps, the one unilateral, the other more symmetrical and 3-lobed.

Figures 12–26 are all enlarged 193 diameters and are all drawn from the type material, *no. 315* (Castle Harbor, Bermuda). The outer limits of the gelatinous cell-walls are scarcely visible except by staining and the lines as drawn give an exaggerated idea of their distinctness.

Addendum

While this paper is going through the press and is in the paged-proof stage, an opportune communication from Mr. J. R. Tovey, acting curator of the National Herbarium of Victoria, Australia, reaches us, enclosing a portion of the original specimen of Kützing's *Halimeda brevicaulis*, a species which is discussed on page 564. As is true in the case of several other species, Kützing evidently saw the plant in "Herb. Sonder," which is now in the possession of the National Herbarium of Victoria. The label of the specimen in question, a transcription of which we owe to the kindness of Mr. Tovey, reads, "*Halimeda brevicaulis* Kuetz. Tab. Phyc. VIII. tab. 25. India occidental." In the place of original publication, the locality is given as "Bahamas-Inseln," but the fragment sent by Mr. Tovey is manifestly the very one sketched by Kützing in his figure *b*. The plant is not *Halimeda favulosa;* as already surmised (page 564), it is probably to be considered a lax flaccid condition of *H. tridens* (*H. incrassata*). The peripheral utricles, however, are rather larger than is usual in *H. tridens*, measuring 50–80 μ in diameter in surface view; the filaments of the central strand cohere at the nodes.

Mr. Tovey kindly sends us also fragments of the flabellum and stipe of Kützing's *Rhipilia longicaulis*, to which we have alluded on pages 567 and 568. These indicate clearly, we think, that the species is the same as the more recently published *Avrainvillea Mazei* Murr. & Boodle. The filaments of the flabellum are now and then slightly torulose, but they are mostly cylindrical without constrictions, except for the strong one where they leave the dichotomy; the ends of some of the branches are thin-walled and shriveled, but they are not destitute of chlorophyl and should not be considered hairs.

The genus Alcicornium of Gaudichaud

LUCIEN MARCUS UNDERWOOD

The adoption of 1753 as the initial date for botanical nomenclature in the Rochester rules of 1892, ratified by the Genoa botanical congress in the same year, reiterated by various botanical organizations down to the present year, and now almost universally accepted by botanists, settled a supplementary but more fundamental problem which had hitherto been an obstacle to the progress of a correct understanding of genera. The principle thus established is briefly stated as follows: *A genus is a group of closely related species and not a definition.* The converse view of this principle has led to untold misconceptions in regard to a proper understanding of what genera really are, particularly among the ferns. If a species has no near relations it will form a monotypic genus concerning whose nomenclatorial type there can be no question; nevertheless, in the practice of the past, generic names of this sort have often been passed along from the original monotype to species later added, until in their present acceptance they would not be recognized by their founders. Linnaeus' *Species Plantarum* contains no diagnoses of genera, and as a necessary corollary, a genus may be founded at any time by giving a generic name to a species or group of species. Such a genus is "*rite* published," to quote an expression from an author on whose restrictions this article is in part a protest. Botanical literature has frequent examples of such publications, of which I cite a single one which has recently been accepted without question:

In an "observatio" appended to the description of the genus *Bolbitis*, Schott (Gen. Fil. *pl. 14*) says: "Praeter *Bolbitin* alia duo genera: *Elaphoglossum* et *Rhipidopteris*, ab Acrostichis genuinis sunt segreganda. Prioris generis exempla sunt: E. simplex, conforme, apodum, viscosum, vestitum, etc. (Acrost. simplex, conforme etc. Auctorum); posterioris * * *." (1834.)

This is the proper starting point of the genus *Elaphoglossum*, and no one has seemed to take the gerundive construction in any other way than an intention on the part of the author to here establish a new genus. A few years earlier Gaudichaud, in the

narrative of his report on the voyage of *l'Uranie* says (page 48): "On trouve de plus une fougère très-remarquable qui abonde sur les rameaux de tous les tamariniers: c'est l'*Acrostichum alcicorne*, ou du moins une espèce ou variété du genre (*Alcicornium*) qu'on ne manquera pas de faire de ces plantes dès qu'elles seront mieux examinées." We can hardly discern the distinction between this case and that of *Elaphoglossum*, and we must consider the genus *Alcicornium* as "*rite* published" by the association of a generic name with a type species; and Mr. Christensen, who includes among certain just criticisms * of my recognition of fern genera of the Old World a rejection of this genus, is surely inconsistent in taking up *Elaphoglossum* while denying validity to *Alcicornium*. It is true that in the latter case Gaudichaud withdrew his name in the same work (page 307), but there was an interval of nearly two years between the first publication and the second,† during which Desvaux published the genus *Platycerium* more formally, and Gaudichaud with the characteristic "après vous, monsieur" of French courtesy simply withdrew his genus in deference to Desvaux. It is a generally recognized principle of biological nomenclature that "a name is a name," and that a genus once published cannot be withdrawn from nomenclature even by its own author. The only reason for withdrawing a published name is the proof that it is either a synonym or a homonym. If Desvaux had not published *Platycerium* in 1827 no one would have hesitated to cite *Alcicornium* as dating from its first publication at page 48 of Freycinet's voyage in 1826. On the principle of priority of publication, therefore, we must accept the name *Alcicornium* as the proper designation for the unique genus of stag-horn ferns.‡ If

* Christensen. On the American species of *Leptochilus* sect. Bolbitis. Bot. Tidssk. **26**: 283–300. 1904. Much of Mr. Christensen's criticism is based on a misconception of my point of view; our conceptions of the limitations of genera are wholly different. In the single case of *Belvisia* I had overlooked the synoptical publication of the genus in which the order of the species is inverted from that in its more formal publication in the text. This transfers *Belvisia* from *Acrostichum spicatum* to *A. septentrionale* (*Asplenium septentrionale* Hoffm.).

† The date of the publication of pages 1–48 of Freycinet's voyage is 1826. The date of the publication of pages 265–312, including the withdrawal of *Alcicornium*, is 1828. *Cf.* Jour. Bot. **39**: 206. 1901.

‡ In raising this group to a tribal alliance (Bull. Torrey Club **30**: 672) we overlooked the fact that this had already been done by the acute John Smith in his *Historia Filicum*, 122. 1875. We would now exclude from the tribe the peculiar genus *Cheiropleuria* placed in this alliance by Diels (Die nat. Pflanzenfam. **1**[4]: 336) as more properly representing, in its vascular system particularly, a high degree of differentiation in the tribe *Acrosticheae*.

we were to decide nomenclature on a principle of purely temporizing expediency and in entire disregard of principles, as advocated at the recent Vienna congress, we might argue the continuance of the name *Platycerium*, but once adopting the principle of priority of publication as a fundamental law and the date of 1753 as initial, which annuls the old conceptual idea of a genus, we are forced to adopt *Alcicornium*.

The stag-horn ferns, which have attracted attention since the time of Plukenet, two centuries ago, by their bizarre appearance and habit of growth, are, with one exception, confined to the tropical and sub-temperate regions of the Old World. Except for Hooker's treatment in *Species Filicum* they have never been monographed, and as the recent literature relating to individual species is greatly scattered we present this preliminary revision with references to the numerous illustrations that have been published, particularly since these ferns are attracting considerable attention in cultivation at the present time. In this connection we shall attempt to elucidate the nomenclatorial tangle not only of the generic name but of the specific name of one of the commonest species, since two of the species of the genus have been more or less mixed during their entire history.*

In 1705 Plukenet (Amal. Bot. *pl. 429. f. 2*) figured a sterile African plant with the designation *Neuroplatyceros aethiopicus, nervosis foliis, cornu cervinum referentibus* (page 151).

Müller, in 1785, described *Osmunda coronaria* (= *Alcicornium coronarium*) from Siam.

Willemet was the first to describe *Acrostichum alcicorne*, in 1796 (Usteri, Ann. **6**[18]: 61), as follows:

> *Acrostichum* (*alcicorne*) frondiformibus lobatis: lobis dichotomis. N. Habitat in Madagascaria.
>
> Stadtmannus plantam siccam dabat.
>
> Fructificatio non adest in meo specimine. In altero loborum aversam partem occupabat.

In 1799 Cavanilles (Anal. Hist. Nat. **1**: 105) described *Acrostichum bifurcatum* from Port Jackson, New Holland.

In Schrader's Jour. für die Botanik (**1800**[2]: 11. 1801) Swartz described an *Acrosticum alcicorne* with no reference whatever to

* *Cf.* Carruthers. The Nomenclature of *Platycerium*. Jour. Bot. **38**: 123–125. 1900. Mr. Carruthers gives a number of interesting points on the early history of the species, but does not begin to fathom the nomenclatorial difficulties.

Willemet but cited Plukenet's figure; he apparently mixed two species in his account in his expressions "*laciniis* * * * *versus apices fructiferis*" and "*foliis primordialibus reniformibus lobatis venosis.*"

In 1804 Schkuhr (Crypt. Gewächs. 1. *pl. 2*) reproduced Plukenet's figure in color, adding Willemet's citation with a ?, using the name *Acrostichum alcicorne* without adding to the knowledge of the subject.

In 1806 Palisot de Beauvois (Fl. d'Oware et de Benin. 2. *pl. 2*) described and figured *Acrostichum Stemaria* in color, collected by Commerson in Madagascar.

In 1806 Swartz (Syn. Fil. 12 and 196) jumbled most that had been previously published under the name *Acrostichum alcicorne*, citing Plukenet, Cavanilles, and Schkuhr. Among his "*Inquirendae*" (page 17) he placed the citation of *Acrostichum alcicorne* Willemet.

In 1810 Willdenow, with a modified description of his own, continued the same jumble of references (Sp. Pl. **5**: 111).

In 1827 Desvaux (Mém. Linn. Soc. **6**: 213) established the genus *Platycerium* with the following species:

P. ALCICORNE = *Acrostichum alcicorne* Sw. in part.
P. STEMMARIA = *Acrostichum Stemaria* Beauv. (*A. bifurcatum* Cav.?).
P. ANGUSTATUM = *A. alcicorne* R. Br. Prod. Fl. Nov. Holl. 145, not Sw.
P. CORONARIUM = *Osmunda coronaria* Müll. (*Acrostichum biforme* Sw.).

Presl 1836 (Tent. Pterid. 239–240) took up *Platycerium* with three species:

P. alcicorne Gaud. (*P. angustatum* Desv.).
P. biforme (*P. coronarium* Desv., *Acrostichum biforme* Sw.).
P. Stemaria (*Acrostichum Stemaria* Beauv.).

In 1841 John Smith added a fourth species (Jour. Bot. **3**: 402) from the Philippines as *Platycerium grande* ("*Acrostichum grande* A. Cunn."), which remained a *nomen nudum* until it was described in 1845 as *Nevroplatyceros grandis* Fée, Mém. Foug. **2**: 103, and in 1852 * as *Platycerium grande* Presl, Epim. Bot. 154.

* [According to J. Müller (Muell.-Arg.) in De Candolle's *Prodromus* (**15**^{2}: 258. 1862), Presl's *Epimeliae Botanicae*, although bearing the title-page date 1849, was not published until 1852; and as negative evidence, in favor of Müller's assertion, may

In 1845 Fée (Mém. Foug. **2**: 102–104) took up the genus *Nevroplatyceros* from Plukenet and recognized four species, viz.:

N. alcicornis, *N. aethiopicus* Pluk. (*Acrostichum Stemaria* Beauv.), *N. grandis* and *N. biformis*. The first three were placed in the § *Platyceria* and the last named in the § *Scutigera*. A fine plate (*pl. 64*) was given of the second species.

In 1864 Hooker (Sp. Fil. **5**: 282–285) again recognized *Platycerium* with species as follows:

1. *P. alcicorne* Desv.
2. *P. aethiopicum* Hook.
3. *P. grande* J. Sm.
4. *P. Wallichii* Hook.
5. *P. biforme* Bl.

In this somewhat tedious recital we can see from our present viewpoint that during the first half of the last century there were two somewhat common species, the one from Australia with narrow leaves which are usually twice forked and bear the sporangial surfaces on the distal lobes, the other with a broader leaf and usually shorter lobes, bearing the sporangial surface at the extremity of the broadened surface between the lobes. The first, which is the *Platycerium alcicorne* of recent authors, was first described by Cavanilles as *Acrostichum bifurcatum* (type locality, Port Jackson, Australia) and again by Desvaux as *Platycerium angustatum*. Presl recognized this as a distinct species but was unfortunate in the selection of his name, although he specifies that it was the *P. alcicorne* of Gaudichaud and not of previous authors. The second species is from Madagascar and other parts of Africa, where it is the more common species, and was probably the original *Acrostichum alcicorne* Willem. (type locality, Madagascar), and was certainly the *Acrostichum Stemaria* of Beauvois. It is more than likely that a young sterile and possibly abnormal leaf of this species served for the figure of Plukenet which was copied by Schkuhr a hundred years later.

It is, therefore, evident that the name *alcicorne*, which Swartz and his contemporaries used to include both plants, and which

---

be noted the fact that Presl's work was reviewed by Schlechtendahl as a novelty in the Botanische Zeitung, in September 1852 (10: 656, 657). Internal evidence that the final touches were not given to Presl's manuscript until after the close of the year printed on his title-page, is to be found in two direct citations, on page 261, of species published by Kunze in 1850 (Bot. Zeit. 8: 57, 58. 25 Ja 1850). Finally, an inspection of the original paper cover of the *Epimeliae* shows that it is dated (on last page) "Pragae, 1851." —— J. H. B., ED.]

later authors with more or less precision, commencing with Gaudichaud and Presl, have used for the Australian species, does not belong with it, and that only with doubt can *Acrostichum alcicorne* Willem., in the absence of its type, be referred to any species known to-day. The overwhelming probability, however, points to it as being the same as *Acrostichum Stemaria* Beauvois.

With these modifications of existing nomenclature we proceed to an enumeration of the species, of which there appear to be thirteen known at the present time; of these eight species are in cultivation at the Royal Botanical Garden at Kew, and seven species at the New York Botanical Garden. Three species we have seen only in herbarium collections, and there is only one (*A. sumbawense*) which we have not seen in some form.

Synopsis of the species of Alcicornium*

Sporophyls broad, with no narrow strap-like divisions.
- Sporophyls rounded at the apex, with entire or repand margins; sporangial area oval; basal leaves erect. — 2. *A. angolense.*
- Sporophyls more or less lobed at the apex.
  - Apex with two rounded lobes; margins otherwise entire; sporangial areas reniform. — 5. *A. Ellisii.*
  - Apex with irregular margins showing manifest tendency to fork; sporangial areas irregular in shape following the outline of the leaf; basal leaves thick, with deep irregular pits when dry. — 8. *A. madagascariense.*

Sporophyls with narrow strap-like lobes, in shape resembling a stag's horn.
- Sporangial areas on a stalked scutiform disc. — 4. *A. coronarium.*
- Sporangial areas on the surface of the sporophyl.
  - Sporangial areas at or below the forks and not on the strap-like lobes of the leaf.

---

* We add here the original description of the only species not seen:

"*P. sumbawense* n. sp. Christ.

Inter P. alcicorne Desv. et P. Wallichii Hook. habitu intermedium, sed omnium angustissimum. Frondibus fertilibus pallidis binis, ternis sive quinis, ligulatis loriformibus, ad basin sensim attenuatis, 65 cm longis, parte latissima 3 cm latis, sulcato-nervosis, adpresse floccosis, media circiter longitudine dichotomo-divisis, atque iterum bis dichotomis, segmentis ultimis furcatis (laciniis ultimis usque ad 20 pro fronde) lanceolato-triangularibus rostratis, involutis, 7 ad 6 cm longis obtusiusculis, omnibus soriferis, soris faciem inferiorem usque ad basin laciniarum omnino tegentibus, immature pube densa albida obtectis, mature rufis partim ista pube tectis. Frondibus sterilibus, politis nitidis scariosis fragilibus spongiosis ochraceo-fulvis reniformi-rotundatis 15 ad 30 cm diametro, margine laciniatis laciniis profundis furcatis. Nervis conspicuis areolas elongatas angulosas formantibus, nervulis aliquot lateralibus liberis inclusis.

Differt a P. alcicorni lamina magis decomposita, angusta, segmentis multo minoribus, rostratis, numerosis. Differt a P. Wallichii statura multo minore, omnibus partibus angustioribus, et soris terminalibus nec in sinu ramorum positis." Warburg, Monsunia 1: 64. 1900.

Sporangial area on an enlarged basal portion of the sporophyl. 6. *A. grande.*
Sporangial area at the sinus of the second fork of the sporophyl.
Basal leaves laciniate into strap-shaped lobes; sporangial areas oval, on a modified portion of the sporophyl. 12. *A. Wallichii.*
Basal leaves undulate or entire at the margins; sporangial area triangular, on the unmodified surface of the sporophyl. 9. *A. Stemaria.*
Sporangial areas on the narrow strap-like lobes of the sporophyl, only exceptionally extending below the sinus.
Sporophyls rigid, erect in growth, gradually widening upwards and then forming several lobes or divisions.
Bright-green both sides; sporangia-bearing divisions broad (5–8 cm.). 7. *A. Hillii.*
White both sides but becoming greenish above from the deciduous stellate scales; sporangia-bearing divisions narrow (2.5 cm. or less wide). 11. *A. Veitchii.*
Sporophyls lax, pendent in growth.
Sporangial areas on or near the apices of the lobes. (Species of the Old World).
Basal leaves erect and foliaceous; sporophyls many times forked. 13. *A. Willinckii.*
Basal leaves remaining flat and disc-like; leaves 2–3 forked. 3. *A. bifurcatum.*
Sporangial areas medial on the sporophyls. (Andine species.) 1. *A. andinum.*

1. **Alcicornium andinum** (Baker)

Platycerium andinum Baker, Ann. Bot. **5**: 496. 1891; New Ferns 113. 1892. (Type from Peru, *Spruce 4729.*)

RANGE: Mountains of Peru and Bolivia, first collected by Spruce. The only American species known; strangely confused by Hooker with *A. bifurcatum.*

2. **Alcicornium angolense** (Welw.)

Platycerium angolense Welw.; Hooker & Baker, Syn. Fil. 425. 1868. (Type from Angola, *Welwitsch.*)

Platycerium Elephantotis Schweinf. Bot. Zeitung **29**: 361. *fig.* 1878. (Type from central Africa.)

RANGE: Tropical Africa.

ICON.: Gard. Chron. III. **23**: 155. *f. 62.* 1898; Rev. Hort. Belge **28**: 85. *pl.* 1902; Schweinfurth *loc. cit.*

Schweinfurth's wood cut illustration is very misleading and does not at all compare with his specimens at Kew, which differ in no particular from *A. angolense.*

3. **Alcicornium bifurcatum** (Cav.)

Acrostichum bifurcatum Cav. Anal. Hist. Nat. **1**: 105. 1799. (Type from Port Jackson, Australia.)

Platycerium angustatum Desv. Mem. Linn. Soc. Paris **6**: 213. 1827. (Type from Australia.)

Acrostichum alcicorne R. Br. and *in parte minore* of Swartz and Willdenow. Not *A. alcicorne* Willem.

Platycerium alcicorne of Gaudichaud and Presl.

RANGE: Australia, Lord Howe Island, New Caledonia; possibly extending to Africa, but exact data are wanting.

ICON.: Turpin, Dict. Hist. Nat. (Atlas); Bot. Register **3**: *pl. 262, 263.*

4. **Alcicornium coronarium** (Müller)

Osmunda coronaria Müller, Naturforscher **21**: 107. *pl. 3.* 1785. (Type from Siam.)

Acrostichum biforme Sw. Jour. für die Bot. (Schrader) **1800**[2]: 11. 1801.

Platycerium coronarium Desv. Mém. Linn. Soc. Paris **6**: 213. 1827.

Platycerium biforme Blume, Fl. Jav. Fil. 44. *pl. 18.* 1829.

Nevroplatyceros biformis Fée, Mém. Foug. **2**: 104. 1844–5.

RANGE: East Indies from Siam to Penang, Singapore, Sumatra, Borneo and the Philippines.

ICON.: Müller *loc. cit.*; Blume *loc. cit.*; Beddome, Ferns of Brit. India *pl. 224.*

5. **Alcicornium Ellisii** (Baker)

Platycerium Ellisii Baker, Jour. Linn. Soc. **15**: 421. 1876. (Type from Madagascar, *Ellis.*)

RANGE: Known only from central Madagascar.

ICON.: Baker, Hook. Ic. Pl. **17**: *pl. 1695.*

6. **Alcicornium grande** (J. Sm.)

Platycerium grande J. Sm. Jour. Bot. (Hooker) **3**: 402.

1841 (*nomen nudum*); Presl, Epim. Bot. 154. 1852.* (Type from the Philippines.)

Nevroplatyceros grandis Fée, Mém. Foug. **2**: 103. 1845.

RANGE: East Indies from Singapore to North Borneo and the Philippines; also Moreton Bay, Australia.

ICON.: Hooker, Gen. Fil. *pl. 80B* (as *Pl. biforme*); Hooker, Fil. Exot. *pl. 86*; Beddome, Ferns of Brit. India *pl. 326*; Gard. Chron. III. **28**: 433. *f. 134*.

7. **Alcicornium Hillii** (Moore)

Platycerium Hillii Moore, Gard. Chron. II. **10**: 429. *f. 74–75*. 1878. (Type from Queensland, *Hill.*)

RANGE: Known only from Queensland, Australia.

ICON.: Moore *loc. cit.*

8. **Alcicornium madagascariense** (Baker)

Platycerium madagascariense Baker, Jour. Linn. Soc. **15**: 421. 1876. (Type from Madagascar, *Pool.*)

RANGE: Known only from Madagascar, the type locality.

9. **Alcicornium Stemaria** (Beauv.)

Neuroplatyceros aethiopicus, nervosis foliis, cornu cervinum referentibus. Pluk. Amal. Bot. 151. *pl. 429. f. 2.* 1705.

? *Acrostichum alcicorne* Willemet, Usteri Ann. **6**[18]: 61. 1796. (Type from Madagascar, *Stadtmann.*)

Acrostichum Stemaria Palisot de Beauvois, Fl. d'Oware et de Benin 2. *pl. 2.* 1804. (Type from Madagascar, *Commerson.*)

Platycerium Stemmaria Desv. Mém. Linn. Soc. Paris **6**: 213. 1827.

Nevroplatyceros aethiopicus Fée, Mém. Foug. **2**: 103. *pl. 64.* 1845.

Platycerium aethiopicum Hook. Garden Ferns *pl. 9.* 1861.

Acrostichum alcicorne of Swartz and Willdenow *pro parte majore.*

RANGE: Tropical Africa from Madagascar to Fernando Po, and north to Sierra Leone.

ICON.: Plukenet *loc. cit.*; Beauvois *loc. cit.*; Fée *loc. cit.*; Hooker, Garden Ferns *pl. 9*; J. Sm. Hist. Fil. *pl. 5*.

* See footnote on page 590.

10. **Alcicornium sumbawense** (Christ)

Platycerium sumbawense Christ, in Warburg, Monsunia **1**: 64. 1900. (Type from Sumbawa, *Warburg 17266.*)

RANGE: Known only from its type.

This species is possibly not distinct from *A. Willinckii,* so far as one can judge by the description (*q. v.*, page 592, note).

11. **Alcicornium Veitchii** sp. nov.

Platycerium Veitchii Gard. Chron. III. **19**: 652. 1896; Jour. Roy. Hort. Soc. **20**: lxxxiii. 1896 (*nomen nudum*).

Basal leaves appressed, soon becoming brownish; spore-bearing leaves cespitose (up to 11 in the cluster), 60 cm. or more long, narrow at the base, tapering gradually to a width of 5–10 cm. or more, then dividing into 6–8 narrow pseudopalmate lobes, 10–20 cm. long by 2–2.5 cm. wide, all becoming more or less sporangiferous in irregular areas; upper surface grayish-scurfy from the quantities of stellate hairs which soon become loosened, finally smoothish in irregular areas from these hairs becoming deciduous; under surface clear white from the abundant, crowded, silvery, star-like matted hairs.

Imported from Adelaide, Australia with other plants by Messrs. Veitch, the horticulturists for whom the species is named, and by them publicly exhibited in 1896. Described from living plants in hort. Kew, September, 1905.

A very distinct species of rigid habit quite in contrast with the other Australian members of the genus.

12. **Alcicornium Wallichii** (Hook.)

Platycerium Wallichii Hook. Gard. Chron. **1858**: 764. 1858.

RANGE: India (type from the banks of the Irawaddy, *Wallich*).

ICON.: Hooker, Fil. Exot. *pl. 97;* Beddome, Ferns of British India *pl. 108.*

13. **Alcicornium Willinckii** (Moore)

Platycerium Willinckii Moore, Gard. Chron. II. **3**: 302. *f. 56.* 1875.

RANGE: Java (type from Java, whence it was introduced to cultivation by Willinck about 1873).

ICON.: Moore *loc. cit.;* Garden **10**: 383. *f.* 1876.

COLUMBIA UNIVERSITY.

Studies on the Rocky Mountain flora—XV

Per Axel Rydberg

In preparing my Flora of Colorado, to be issued as a Bulletin from the Agricultural College at Fort Collins, Colorado, and now in press, I have found it necessary to change the nomenclature of a number of species. As the scope of the Flora comprises only keys to the families, genera and species, and an enumeration of localities where specimens have been collected, it has been impossible to include therein any fuller synonomy with citations, or any discussions. It has, therefore, seemed advisable to make the publication of these changes and notes elsewhere.

Caryopitys monophylla (Torr. & Frém.) Rydb.

Pinus monophyllus Torr. & Frém. Rep. 319. 1845.

Dr. Small in his Flora of the Southeastern United States has followed the more modern views in dividing genera, which consist of very natural sections or subgenera, into as many separate genera. The genus *Pinus* as usually treated contains at least four distinct subgenera, better defined and more easily distinguished from each other, than for instance *Picea* and *Tsuga*. Three of these had already generic names, *viz.: Pinus* L. (proper), *Apinus* Necker and *Strobus* Opiz. Dr. Small had to give the fourth group, which is wholly American, a new name, *Caryopitys*. In the Rocky Mountain region the genus is represented by the type species *C. edulis* (Engelm.) Small, and by the species given above. One of the four genera is not represented within the area covered by Dr. Small's work, *viz.:*

Apinus Necker, Elem. Bot. **3**: 269. 1790

Most of Necker's genera are hard to determine, but in this case Necker not only gives the characters by which he distinguishes the genus from *Pinus* proper, but also cites two species, *viz.: cembra* and *pinea*. In the Kew Index, the genus is given, but no species are mentioned. The way in which Necker makes

his statement, there is all the reason to claim that the two species are there published as *Apinus*. Necker states that *Larix* contains 3 species, *viz.: decidua, cedrus* and *strobus; Pinus* 2, *sylvestris* and *taeda: Apinus* also 2, *viz.: cembra* and *pinea*, but *Abies* 5, etc. If Necker had meant that these were the Linnaean species of *Pinus* to be distributed among the different genera, he would have stated it differently. There was no *Pinus decidua* L., but a *Pinus Larix* L. and a *Larix decidua* Miller. *Apinus* is most related to *Strobus*, but differs in the thick cone-scales, the erect or horizontal instead of pendent cone and a very hard-shelled seed with only a vestige of a wing. In the Rocky Mountains, it is represented by the two following species:

Apinus flexilis (James) Rydb.

Pinus flexilis James, in Long's Exped. **2**: 34. 1823.

Apinus albicaulis (Engelm.) Rydb.

Pinus albicaulis Engelm. Trans. Acad. St. Louis **2**: 209. 1863.

Sabina utahensis (Engelm.) Rydb.

Juniperus californica utahensis Engelm. Trans. Acad. St. Louis **3**: 588. 1877.

Haller's genus *Sabina* is also one just as consistently taken up by Dr. Small. I shall here give only the Rocky Mountain species to be referred to this genus.

Sabina monosperma (Engelm.) Rydb.

Juniperus occidentalis monosperma Engelm. Trans. Acad. St. Louis **3**: 590. 1877.

Sabina Knightii (A. Nels.) Rydb.

Juniperus Knightii A. Nels. Bot. Gaz. **25**: 198. 1898.

Sabina scopulorum (Sargent) Rydb.

Juniperus scopulorum Sargent, Garden and Forest **10**: 420. 1897.

Sparganium multipedunculatum (Morong) Rydb.

Sparganium simplex multipedunculata Morong, Bull. Torrey Club **15**: 79. 1888.

This is quite distinct from *S. simplex* L. To the characters given by the late Dr. Morong may be added the broad scarious margins of the leaf-sheaths. This character it has in common with *S. americanum* Nutt. of the eastern United States and *S. subvaginatum* Meinsh. of Europe. In fact, Meinshausen included C. C. Parry's plant from Colorado in the latter. It is, however, very doubtful if it belong there, for the original description of *S. subvaginatum* does not fit our plant very well. *S. multipedunculatum* ranges from the Mackenzie River and Washington to Colorado.

Potamogeton Richardsonii (Bennett) Rydb.

Potamogeton perfoliatus lanceolatus Robbins, in A. Gray, Man. ed. 5. 488. 1867. Not *P. perfoliatus lanceolatus* Blytt. 1861.

Potamogeton perfoliatus Richardsonii Bennett, Jour. Bot. **27**: 25. 1889.

Our common North American plant does not seem to intergrade at all with the true *P. perfoliatus* L.

Stipa Porteri Rydb.

Stipa mongolica (Thurber, in A. Gray, Proc. Acad. Phila. **1863**: 79, hyponym. 1863.) Port. & Coult. Syn. Fl. Colo. 145. 1874. Not *S. mongolica* Turcz.

In the enumeration of Hall and Harbour's plants, Thurber determined this plant as *S. mongolica* Turcz., which is evidently erroneous. He gives the name and a short discussion but no description. A good description was afterwards given by Porter and Coulter in the Synopsis of the Flora of Colorado.

Muhlenbergia cuspidata (Torr.) Rydb.

Vilfa cuspidata Torr.; Hook. Fl. Bor. Am. **2**: 238. 1839.

Sporobolus cuspidata Wood, Bot. & Fl. 385. 1870.

The group of grasses, which Torrey, Trinius and Thurber regarded as a good generic type and for which they adopted the name *Vilfa*, is altogether out of place in the genus *Sporobolus*, where its species have been placed by authors. They are no "Drop-seed" grasses at all, the grain remaining enclosed in the firm flowering glume. They should be taken out of *Sporobolus*, but if they should constitute a genus by themselves is question-

able. The generic name *Vilfa* is not available, for the type of *Vilfa* Adans. is apparently a species of *Agrostis*. As there is no character, whatever, to separate these plants from *Muhlenbergia* as now limited, the only rational way to treat them at present is to transfer them all to *Muhlenbergia*. At any rate, they are congeneric with *M. Wrightii* Vasey, slender specimens of which are very hard to distinguish from *M. cuspidata* here proposed. The other Rocky Mountain species are:

Muhlenbergia Richardsonis (Trin.) Rydb.

Vilfa Richardsonis Trin. Mem. Acad. St. Petersb. VI. Nat. **5**[2]: 103. 1840.

? *Agrostis brevifolia* Nutt. Gen. **1**: 44. 1818.

The specific name *brevifolia* may have to be taken up for this species, but it is doubtful if *Agrostis brevifolia* is a synonym of this. Professor Scribner claims that it belongs to the preceding species. What *Vilfa Richardsonis* Trin. is, is not doubtful, and that specific name is therefore preferable.

Muhlenbergia simplex (Scribn.) Rydb.

Sporobolus simplex Scribn. Bull. U. S. Div. Agrost. **11**: 48. 1898.

Muhlenbergia filiformis (Thurber) Rydb.

Vilfa depauperata filiformis Thurb.; S. Wats. Bot. King's Expl. 376. 1871.

Vilfa gracillima Thurb. Bot. Calif. **2**: 268. 1880. Not *Muhlenbergia gracillima* Torr. 1856.

Sporobolus filiformis Rydb. Contr. U. S. Nat. Herb. **3**: 189. 1895.

Muhlenbergia aristulata Rydb.

Sporobolus aristatus Rydb. Bull. Torrey Club **28**: 266. 1901. Not *Muhlenbergia aristata* Pers. 1805.

Muhlenbergia Wolfii (Vasey) Rydb.

Vilfa minima Vasey, Bot. Wheeler Surv. 282. 1878. Not *V. minima* Trin. 1855.

Sporobolus Wolfii Vasey, Bull. Torrey Club **10**: 52. 1883.

Muhlenbergia Thurberi Rydb.

Sporobolus filiculmis Vasey; Beal, Grasses N. Am. **2**: 288. 1896. Not *S. filiculmis* Dewey. 1894.

Vilfa filiculmis Thurber; Beal, *l. c.*, as a synonym.

Both *Sporobolus filiculmis* Vasey and *Vilfa filiculmis* Thurber appeared in 1885 in Vasey's Catalogue of the Grasses of United States, on page 44; but both are there nomina nuda and the first place where a description is published is, as far as I can find, in Beal's Grasses of North America. In the meantime Dewey had published another *Sporobolus filiculmis* which invalidates that specific name.

Sporobolus flexuosus (Thurber) Rydb.

Sporobolus cryptandrus flexuosus Thurber; Vasey, Bot. Wheeler Surv. 282. 1878.

This is evidently specifically distinct from *S. cryptandrus*.

Deschampsia alpicola Rydb. sp. nov.

Deschampsia caespitosa alpina Vasey; Beal, Grasses N. Am. **2**: 368; at least in part. 1896. Not *D. alpina* R. & S. 1817.

Densely cespitose, tufted perennial; sterile shoots numerous; sheaths 2–3 cm. long, glabrous, striate; ligules linear-lanceolate, acuminate, about 5 mm. long; blades 1–2 dm. long, 1–2 mm. wide, stiff, often more or less involute; culm-leaves with sheaths 1–1.5 dm. long and blades 1–4 cm. long; culms 3–5 dm. high; panicle short, open, 8–15 cm. long, its branches in 2's to 5's, 3–6 cm. long, soon spreading; spikelets about 5 mm. long; empty glumes about 4 mm. long, lanceolate, acute; flowering glume nearly as long, hirsute at the base; awn attached one-third or one-fourth from the base, one and a half to two times as long as the glume, bent and twisted.

This differs from *D. caespitosa* in the large flowers and the long awns. It has been mistaken for *D. bottnica*, but that species has long narrow inflorescence and comparatively longer empty glumes. *D. alpicola* is rather common in alpine regions of Colorado. A similar if not identical form is also found in Alaska. As the type may be designated:

COLORADO: Mountain meadows, Pike's Peak, Sept. 4, 1901, at an altitude of 3600 meters, *L. M. Underwood XX*.

Graphephorum Shearii (Scribn.) Rydb.

Trisetum argenteum Scribn. Bull. U. S. Div. Agrost. **11**: 49. 1898. Not *T. argenteum* R. & S. 1817.

Trisetum Shearii Scribn. Circ. U. S. Div. Agrost. **30**: 8. 1901.

Professor Scribner has merged *Graphephorum* into *Trisetum*. I think, though, that they should be retained as two distinct genera, even if the former should be transferred to the tribe *Aveneae*.

Distichlis stricta (Torr.) Rydb.

Uniola stricta Torr. Ann. Lyc. N. Y. **1**: 155. 1824.

Distichlis maritima stricta Thurber, Bot. Calif. **2**: 306. 1880.

Distichlis spicata stricta Scribn. Mem. Torrey Club **5**: 51. 1894.

Eatonia robusta (Vasey) Rydb.

Eatonia obtusata robusta Vasey; Beal, Grasses N. Am. **2**: 493. 1896.

To the characters given in the original description should be added: intermediate nerves of the second glume very strong, and leaf-blades firm, much broader than the sheaths, and therefore forming distinct auricles at the base. The nerves mentioned are in this species almost as prominent as the lateral nerves. In *E. obtusata* they are faint, while the lateral ones are very prominent.

Eatonia intermedia Rydb. sp. nov.

Culm 6–8 dm. high, 1.5–2.5 mm. thick, striate, shining; sheaths 5–15 cm. long, striate, minutely scabrous; ligules about 2 mm. long, truncate, erose and often cleft; blades 8–15 cm. long, 3–5 mm. wide, usually flat, broader than the sheaths and therefore forming distinct auricles at the base; inflorescence rather narrow and dense, 8–15 cm. long, 1–3 cm. wide; spikelet usually 2-flowered; first empty glume about 2 mm. long, subulate, scabrous on the back; second empty glume oblanceolate in side view, rather firm, slightly scarious on the margin, with prominent scabrous nerves, obtusish, about as wide as the flowering glumes, a little over 2 mm. long and 0.5 mm. wide; flowering glume oblong-lanceolate in side-view, rather firm, with faint nerves and minutely scabrous; palate narrowly linear, scarious.

This species has been named both *E. obtusata* and *E. pennsylvanica*, and is intermediate between the two. From the former it

differs in the narrower second glume, which is scarcely broader than the flowering glume and neither truncate nor cucullate at the apex; from *E. pennsylvanica* it differs in the denser inflorescence and the firmer and less acute second glume, which has the texture of that of *E. obtusata.* In *E. pennsylvanica* the second empty glume is thin, very acute and with a broad scarious margin.

A few of the specimens to be referred to this are given here:

MONTANA: East Gallatin Swamps, July 24, 1896, *P. A. Rydberg 3174* (type) and *3173;* Columbia Falls, 1893, *R. S. Williams;* Blue Cloud, near Helena, 1887, *F. D. Kelsey.*

COLORADO: Gunnison, 1901, *C. F. Baker 524;* Pagosa Springs, 1899, *Baker 169;* Durango, 1898, *Baker, Earle & Tracy 950* (the last determined as *Agrostis exarata*).

Poa callichroa Rydb. sp. nov.

Perennial with a horizontal rootstock, but more or less matted; culm about 3 dm. high, mostly leafy at the base; sheaths strongly striate, 2–10 cm. long; ligules lanceolate or ovate, acute, about 3 mm. long; blades of the lower leaves 6–10 cm. long, 3–4 mm. wide, firm, dark-green, strongly veined; blades of the upper leaves about 3 cm. long, erect; panicle 6–9 cm. long, open; branches mostly in 3's or 4's below, the lowermost 2–3 cm. long; spikelets 6–8 mm. long, 5–7-flowered; empty glumes lanceolate in side-view, about 5 mm. long, acuminate, purple with greenish or brownish margins; flowering glumes 4–5 mm. long, lanceolate, acuminate, with strong nerves, green below, then purple, then brown, and white and scarious above; nerves and internerves more or less villous; cobweb at the base present but scant.

This species is a relative of *P. arctica* and *P. cenisia,* but differs from both in the taller habit, broader leaves and larger, 5–7-flowered (instead of 3–4-flowered) spikelets.

COLORADO: Dead Lake, near Pike's Peak, August 14, 1901, *F. E. & E. S. Clements 457.*

Poa pudica Rydb. sp. nov.

Perennial with a short rootstock and often tufted; culm 2–3 dm. high; lower leaves with short sheaths, which are often rather loose; ligules truncate, about 2 mm. long; blades 4–5 cm. long, usually conduplicate, strongly nerved; sheaths of the stem-leaves 5–7 cm. long; blades 2–4 cm. long, erect; panicle 4–8 cm. long,

open; branches usually in pairs, in age reflexed; the lowest 4–5 cm. long, bearing the spikelets near the ends; spikelets 4–5 mm. long, mostly 3-flowered; empty glumes lanceolate in side view, strongly veined, usually purple, acuminate; flowering glumes lanceolate, sharp-acuminate, greenish below, then purplish and scarious at the apex; cobweb present but scant; internerves glabrous and nerves pubescent.

The type specimens were determined by Professor Scribner as *P. arctica*, but it differs from that species in the smaller more sharply acuminate flowering glumes and their glabrous internerves. These characters would place it closer to *P. reflexa*. The latter species is, however, taller, and the intermediate nerves of the flowering glumes are glabrous.

COLORADO: Stephen's Mine, below Gray's Peak, Aug. 23, 1895, *P. A. Rydberg 2443* (type); near Pagosa Peak, Aug. 1899, *C. F. Baker 209* (determined as *P. reflexa*); high mountains about Empire, 1892, *H. N. Patterson 272*.

Poa macroclada Rydb. sp. nov.

Perennial with a horizontal rootstock; culm 6–8 dm. high; sheaths 5–15 cm. long, rather loose, strongly striate, slightly scabrous; ligules ovate, acute, about 2 mm. long; leaf-blades 7–10 cm. long, 2 mm. or less wide, flat, glabrous, firm and dark-green; panicle 2–3 dm. long, open; branches in 3's–5's, in fruit reflexed or spreading, the lower often 1 dm. long, with the spikelets near the ends; spikelets often about 5 mm. long, 2- or 3-flowered; empty glumes lanceolate, very acute, more or less purplish; flowering glume lanceolate, acute or acuminate, glabrous, slightly purple-tinged; intermediate veins faint and cobweb scant.

This species is related to *P. aperta*, but differs in the long slender branches of the panicle and the glabrous flowering glumes.

COLORADO: Roger's, Gunnison Watershed, August 14, 1901, *C. F. Baker 802*.

Poa interior Rydb. sp. nov.

Poa nemoralis Scribn. Bull. U. S. Div. Agrost. **17**: 250. 1899. Not *P. nemoralis* L. 1753.

? *Poa caesia* Coult. Man. Rocky Mt. Reg. 421. 1885. Not *P. caesia* Smith. 1800.

The grass common throughout the Rocky Mountain region and extending in the north from Alaska to the Dakotas and gen-

erally known as *P. nemoralis* is quite different from the European plant. The latter is found in America as sparingly introduced in the Eastern States. The European plant is taller, with soft, flaccid leaves, ovate or lanceolate acute ligules, larger spikelets and narrowly lanceolate empty glumes which are tapering gradually at the apex and much narrower than the flowering glumes. The American plant is usually lower and stiffer, has rather firm leaves, truncate ligules, smaller spikelets, broader empty glumes, which are rather abruptly acuminate and at least the second almost as broad as the flowering glumes. The name *P. nemoralis* was used for the American plant by Hooker and Arnott,* but appears there without a description. It was adopted by several authors on western botany; but, as far as I know, never described under that name, until 1899 by Professor Scribner. His description and plate illustrates the American rather than the European plant. As the type may be designated:

WYOMING: Headwaters of Clear Creek and Crazy Woman River, 1900, *Frank Tweedy 3706*.

Poa phoenicea Rydb. sp. nov.

Perennial with a horizontal rootstock and extravaginal innovations; culm 5–6 dm. high, leafy; sheaths loose, 5–15 cm. long, striate; ligules triangular-lanceolate or ovate, acute, about 5 mm. long; blades 1–2 dm. long, about 2 mm. wide, rather firm, strongly veined; panicle 6–10 cm. long, open, its branches mostly in pairs, the lower 5–6 cm. long; spikelets 4–5-flowered, 6–7 mm. long; empty glumes lanceolate, acuminate, purple or green below and purple above, glabrous and shining; flowering glumes lanceolate, green at the base, purple in the middle and brownish-scarious at the top; both nerves and internerves villous; cobweb none; intermediate nerves very faint.

This species resembles somewhat *P. pseudo-pratensis*, *P. epilis* and *P. purpurascens* Vasey (see below). From the first it differs by the more acuminate glumes, the faint intermediate nerves of the flowering glumes and the longer, narrower leaves; from the other two by the open inflorescence, the villous, not scabrous flowering glumes and the creeping rootstock.

COLORADO: Pike's Peak Valley, Aug. 21, 1901, *F. E. & E. S. Clements 466*.

* Bot. Beech. Voy. 132. 1832.

Poa subpurpurea Rydb. nom. nov.

Poa purpurascens Vasey, Bot. Gaz. **6**: 297. 1881. Not *P. purpurascens* Sprengel. 1819.

Poa tricholepis Rydb. sp. nov.

Perennial with a creeping rootstock and extravaginal innovations; sheaths of the basal leaves short, 2–4 cm. long, strongly striate, rather loose, minutely retrorse-striate; blades 5–10 cm. long, a little over 1 mm. wide, scabrous; sheaths of culm-leaves 7–12 cm. long; blades 2–6 cm. long, sometimes nearly 2 mm. wide; ligules lanceolate, acuminate, about 4 mm. long; culm slender, 3–5 dm. high; panicle 6–8 cm. long, open, its branches in pairs, 2–3 cm. long; spikelets 3–4-flowered, 5–8 mm. long; empty glumes about 4 mm. long, lanceolate in side view, acute, green and purple towards the apex; flowering glumes about 4 mm. long, villous below, strigose above, green, bordered with purple and a scarious border, obtuse.

This is related to *P. Wheeleri* and *P. Vaseyana*, but is easily distinguished from both by the obtuse flowering glume, which is villous below. In the two species mentioned the flowering glume is very acute and strigulose or scabrous throughout, or in *P. Vaseyana* hairy on the nerves only.

COLORADO: Near Pagosa Peak, Aug. 1899, *C. F. Baker 210.*

Poa nematophylla Rydb. sp. nov.

A cespitose bunch-grass; basal leaf-blades short, striate, minutely retrosely strigulose; stipules lanceolate, acuminate, about 3 mm. long; blades 1–1.5 dm. long, filiform, strongly involute, less than 0.5 mm. wide, scabrous-strigulose; culm-leaves few, near the base; sheaths 4–6 cm. long; blades 3–5 cm. long; culm about 3 dm. high, filiform; inflorescence narrow, raceme-like, 2–5 cm. long; branches 2–10 mm. long, bearing often only a single spikelet; spikelets 7–9 mm. long, about 4-flowered; empty glumes about 4 mm. long, lanceolate, glabrous and shining; flowering glumes about 6 mm. long, light-green, with a silvery scarious margin, very acute, strigose below, scabrous-strigulose above.

Related to *Poa idahoensis*, but distinguished by the narrow inflorescence and few racemosely disposed spikelets.

COLORADO: Meeker, Rio Blanco County, June 8, 1902, *G. E. Osterhout 2601.*

Poa confusa Rydb. sp. nov.

A tufted bunch-grass with intravaginal innovations; sheaths of the basal leaves short, striate, glabrous; blades 1–2 dm. long, 2–3 mm. wide, flat or involute, puberulent; culm-leaves several; sheaths 1–1.5 dm. long; blades about 1 dm. long; ligules broadly ovate or rounded, obtuse or acutish, about 2 mm. long; culm 6–9 dm. high; panicle narrow, 1–1.5 dm. long, dense; branches short, strongly ascending; spikelets 7–8 mm. long, usually 4-flowered; empty glumes lanceolate in side-view, shining, minutely strigulose above; flowering glumes narrow, about 3.5 mm. long, obtuse or rounded at the apex, rounded on the back below, strigulose, yellowish-green with brownish scarious margin.

This species has been confused with *P. laevigata*, *P. lucida* and *P. nevadensis*. It differs from the first two by the short and broad ligules (in both the ligules are lanceolate and acuminate), and from the last by the empty glumes and in being scarcely scabrous. In *P. nevadensis* the empty glumes are strongly nerved, elongated-lanceolate, almost equaling the oblong, very scabrous flowering glumes; in *P. confusa* they are faintly nerved, broadly lanceolate, shorter than the flowering glumes. *P. confusa* grows in open "parks" and on hills from Nebraska and Montana to Colorado. As the type may be assigned:

WYOMING: Medicine Bow Mountains, Albany County, July 28, 1900, *Aven Nelson 7787*.

Poa truncata Rydb. sp. nov.

A species related to the preceding but stiffer; basal leaves withering early; sheaths of culm-leaves 10–15 cm. long, with conspicuous hard auricles at the mouth; ligules very short, about 1 mm. long, truncate; blades 1–2 dm. long, 2–3.5 mm. wide, scabrous on the back; culm about 9 dm. high, stiff; panicle about 1.5 dm. long, narrow, with almost erect scabrous branches; spikelets 3–5-flowered, 7–9 mm. long; empty glumes 5–6 mm. long, tinged with purple, scabrous on the nerves; flowering glumes narrow, about 5 mm. long, straw-colored or tinged with purple, strigulose throughout and slightly scabrous on the veins.

The short truncate ligules separate this from the preceding and all other related species.

COLORADO: Dillon, Summit County, August 26, 1896, *F. E. Clements 373*.

Festuca Earlei Rydb. sp. nov.

Perennial with rootstocks and extravaginal innovations; basal leaves with short ligules; blades filiform, 5–10 cm. long, strongly involute, 0.5 mm. wide or less; sheaths of the culm-leaves 3–5 cm. long, striate, smooth; ligules very short, truncate; blades 3–5 cm. long, 1 mm. wide or less; culm about 3 dm. high, very slender; panicle narrow and spike-like, 3–5 cm. long; branches short and erect, smooth; spikelets 2–3-flowered, about 5 mm. long; first empty glume about 2 mm. long, narrowly lanceolate; the second about 3 mm. long, ovate-lanceolate, 3-nerved; flowering glumes narrowly lanceolate, about 4 mm. long, smooth, usually awned; awn 1 mm. or less long.

This species is related to *F. rubra*, but differs in the smaller few-flowered spikelets, the smaller flowering glumes, and the fine, soft leaves.

COLORADO: La Plata Cañon, July 11, 1898, *Baker, Earle & Tracy 920.*

Festuca ingrata (Hack.) Rydb.

Festuca ovina ingrata Hack.; Beal, Grasses N. Am. **2**: 598. 1896.

This is the common plant of the Rocky Mountain region, which has been known under the name *F. ovina*. It is quite different from the European *F. ovina* L. The latter is found in America only in the northeastern part of the continent.

Festuca minutiflora Rydb. sp. nov.

Tufted perennial with intravaginal innovations; leaves mostly basal; sheaths smooth, 1 cm. or so long; ligules 0.75 mm. long, obtuse or rounded at the apex; blades 5–10 cm. long, narrow and flaccid, about 0.5 mm. wide; sheaths of the culm-leaves 2–4 cm. long; blades 1–3 cm. long; culm very slender, 1–1.5 (seldom 3) dm. high; panicle very narrow, lax, 2–4 cm. long, with very short erect branches; spikelets, excluding the awns, about 5 mm. long, 2–3-flowered; first empty glume narrowly lanceolate, 2–2.5 mm. long, acute; the second 2.5–3 mm. long, ovate-lanceolate, short-acuminate or awn-pointed; flowering glume oblong-lanceolate, about 2 mm. long, purple-tinged above, abruptly contracted into a short awn, 1.5 mm. or less.

This is closely related to *F. brachyphylla*, but differs in the smaller spikelets, the more abruptly acuminate flowering glumes, the shorter awns, the laxer panicle and the soft filiform leaves. It

grows in alpine situations of Colorado, at an altitude of 3000–4000 meters, and is found apparently also in California.

COLORADO: Cameron Pass, July 13, 1869, *C. F. Baker* (type); near Pagosa Peak, 1899, *Baker 176*; "Colorado," *E. Hall 12*; Mt. Lincoln, *John Wolf*; Tennessee Pass, 1893, *De Alton Saunders*; Mt. Ouray, 1896, *F. E. Clements 210½*; near Manitou, 1896, *Clements 46*.

CALIFORNIA: *Bolander 5066*.

Elymus strigosus Rydb. sp. nov.

A cespitose perennial; sheaths 3–8 cm. long, striate, glabrous or minutely puberulent, with distinct auricles at the mouth; ligules very short, truncate, 1 mm. long or less; blades 1–2 dm. long, about 3 mm. wide, flat or involute, scabrous; culm 5–7 dm. high; spike 1–1.5 dm. long; spikelets 1 or 2 at each node; empty glumes linear-subulate, 7–9 mm. long, very scabrous; flowering glumes lanceolate, scabrous-strigose, awn-pointed or short-awned, without the awn about 1 cm. long.

This is closely related to *E. ambiguus*, but distinguished by the scabrous strigose flowering glumes, the more scabrous empty glumes and the narrower leaves.

COLORADO: Near Boulder, at an altitude of 2300 meters, July 31, 1886, *C. W. Letterman 553* (type, labeled *Agropyrum dasystachyum*).

WYOMING: Naked shale slopes, Point of Rocks, Sweetwater County, 1900, *Aven Nelson 7151* (labeled *Elymus salinus*).

Elymus villiflorus Rydb. sp. nov.

A cespitose perennial; sheaths 4–10 cm. long, striate, glabrous; blades 1–2 dm. long, about 2 mm. wide, strongly involute, scabrous above; culm 4–6 dm. high, finely retrorse-pubescent above; spike 1–1.5 dm. long; spikelets 1 or 2 at each node; empty glumes subulate, 7–9 mm. long; flowering glumes lanceolate, 5-nerved, villous-hirsute, without the short awn about 1 cm. long.

Closely related to the preceding and *E. ambiguus*, this is characterized by its long-haired and more strongly nerved flowering glume. It grows on plains and foothills at an altitude of 1500–1800 meters.

COLORADO: Near Boulder, July, 1902, *F. Tweedy 4818* (type). ALBERTA: Banff, July 21, 1900, *H. B. Lawson.*

Juncoides intermedium (Thuill.) Rydb.

Juncus intermedius Thuill. Fl. Env. Paris. ed. 2. 178. 1799.
Juncus multiflorus Ehrh.; Hoffm. Fl. Deutschl. ed. 2. **1**: 169. 1800. Not *J. multiflorus* Retz. 1795.

This is the plant that has been known in America under the name *Luzula campestris* or *Juncoides campestre*, but this North European species is found, if at all on this continent, only in the extreme northeastern portion. It is distinguished from *J. intermedium* by its fewer, larger and nodding spikelets. The name *Juncus multiflorus* dates back as far as 1791, when Ehrhart issued his set of grasses, sedges, etc., but as far as can be ascertained, it was never published for this plant before 1800, in the revised edition of Hoffmann's Flora.

Nemexia lasioneuron (Hook.) Rydb.

Smilax lasioneuron Hook. Fl. Bor. Am. **2**: 173. 1838.
Nemexia herbacea melica Aven Nelson, Proc. Biol. Soc. Wash. **17**: 175. 1904.

Ibidium porrifolium (Lindl.) Rydb.

Spiranthes porrifolia Lindl. Gen. & Sp. Orch. 467. 1840.

Mr. House * has shown that *Ibidium* Salisb. is the name that properly should be used for *Spiranthes* Richard and *Gyrostachys* (Pers.) Kuntze; *Ophrys* L. for *Listera* R. Br. and *Cytherea* Salisb. for *Calypso* Salisb. The Rocky Mountain species of these genera, which have not already been transferred, are given here.

Ophrys borealis (Morong) Rydb.

Listera borealis Morong, Bull. Torrey Club **20**: 31. 1893.

Ophrys nephrophylla Rydb.

Listera nephrophylla Rydb. Mem. N. Y. Bot. Gard. **1**: 108. 1900.

Ophrys caurina (Piper) Rydb.

Listera caurina Piper, Erythea **6**: 32. 1898.

NEW YORK BOTANICAL GARDEN.

* Bull. Torrey Club **32**: 378–382. 1905.

New plants from Colorado

GEORGE E. OSTERHOUT

Allionia sessilifolia sp. nov.

Perennial from the root, the stem rather stout, 5–10 dm. high, erect and branched above, angled, glabrous, but the branches glandular-pubescent above; leaves thickish, all sessile, the lower ovate, 6–8 cm. long, 4 cm. wide, rounded at base, the upper narrower becoming smaller and bract-like; inflorescence spreading, the flowers numerous; involucre hirsute, 3-flowered, the flowers longer than the involucre; stamens about four, exserted; fruit 4–5 mm. long, 5-ribbed, having short ridges between the ribs and at right angles to them.

Allionia sessilifolia seems nearest related to *A. pilosa* (Nutt.) Rydb., but is readily distinguished by the glabrous stem and the broader sessile leaves. Collected at Livermore, Larimer County, Colorado, July 25, 1893, *Osterhout 179*.

Aster fluvialis sp. nov.

Perennial from creeping rootstocks, the stem rather slender, 6–10 cm. high, leafy and branched from near the base, or in shade or crowded vegetation more strict, slightly pubescent in lines; leaves lanceolate, tapering to both ends, sessile, the larger ones 1 dm. long, 1 cm. wide, thin, entire, ciliate on the margins, some of them usually with rare denticulations, becoming much smaller on the leafy panicle; inflorescence much branched and paniculate, the the flowers numerous on the leafy branches; heads 7–10 mm. long, or including the rays 15 mm. long; bracts imbricated in successive lengths of four series, close and erect, narrowly spatulate and green-tipped, scarious-margined; rays varying from light- to dark-purple but never white.

This *Aster* has been referred to *A. longifolius* and to *A. paniculatus* and seems to be nearer the latter, but is manifestly neither of them. The flowers are larger than those of *A. paniculatus*, the rays are never white, the leaves are entire and thinner, and the stem is more branched. It is plentiful along the streams and ditches of the plains bordering the foothills on the eastern side of the mountains, flowering in September.

Type specimens collected along the Cache LaPouder river at New Windsor, Colorado, September 11, 1904, *Osterhout 2941*.

Senecio lanatifolius sp. nov.

Senecio Fendleri lanatus Osterhout, Bull. Torrey Club **31**: 358. 1904. Not *Senecio lanatus* L.

Perennial, 1–2 dm. high, several-stemmed from the root, usually branched, very leafy to the inflorescence; leaves linear, pectinate-pinnatifid, the divisions crenate-toothed with inrolled edges, the upper leaves becoming bract-like; both stem and leaves pannose-canescent; peduncles very short; heads many, crowded, almost 1 cm. long, of about seven glabrous bracts in a single row and about 15 flowers; achenes glabrous; *rays none*.

Collected at Wolcott, Eagle County, Colorado, July 11, 1902, *Osterhout 2667*.

Carduus araneosus sp. nov.

Perennial; stem about 5 dm. high, rather slender, branched from about the middle, having a little light tomentum at the time of flowering; lowest leaves not known; stem-leaves linear, 10–12 cm. long, canescent beneath with a close tomentum, bright-green and glabrous above, pinnatifid, the lobes oblong, each tipped by a moderate spine, decurrent on the stem for 3 cm.; heads solitary on peduncles 5–10 cm. long, usually subtended by a linear elongated leaf; involucral bracts in about three series, the outer series about 1 cm. long, a little more than half the length of the second, both gradually tapering from a base 1 mm. wide to a rigid prickly point, and both long-woolly from the margins, the inner bracts weak-pointed, fimbriate-margined and purple-tinged; flowers whitish; pappus tawny, sparingly plumose.

A species somewhat related to *C. Parryi* (A. Gray) Greene, but a slenderer plant, the leaves more tomentose beneath and decurrent on the stem. Collected at Red Cliff, Eagle County, Colorado, June 26, 1900, *Osterhout 2169*.

Carduus spathulatus sp. nov.

Perennial; stem rather slender, 8 dm. high or more, bearing some slight tomentum at the time of flowering, branched toward the summit; lower leaves spatulate, pointed, 1–2 dm. long, 3–4 cm. wide, remotely serrate and with smaller serrations between the teeth, all pointed with small spines; these succeeded by leaves on winged petioles nearly 1 dm. long, pinnately cleft, the divisions

pointed by slender spines, sessile by a clasping base and decurrent on the stem for 1 cm.; all the leaves canescent beneath and with slight tomentum above or glabrous; heads several on leafy peduncles, about 3 cm. high; bracts in 5 series, lanceolate, entire, imbricated in successive lengths, having some webby tomentum on the edges, all tipped with small yellowish spines 5 mm. long, the inner series with somewhat longer but weaker spines, the glandular ridge slight if any; corollas very light-purple or whitish; pappus whitish, plumose, 15 mm. long.

This species is related to *Carduus pulchellus* Greene, but the leaves are much less divided, and the bracts are narrower and the inner not so much elongated. Collected in North Park, Colorado, at the base of the mountains, both on the east and west sides, August 24–27, 1900. Type: *Osterhout 2254*.

NEW WINDSOR, COLORADO.

Observations on the flora of central Chile

George Tracy Hastings

From the fall of 1900 until the spring of 1903 the author held the position of teacher of sciences in the *Instituto Inglés*, an English school in Santiago, Chile. Short holidays during the school year and the long vacation from Christmas to the first of March gave opportunities for collecting trips about the city and to the mountains to the east. In these trips the small lakes in the neighborhood of Santiago were visited and the mountains ascended to a height of twelve thousand feet. The following observations give the results of these trips.

Midway between the damp forests of the south and the deserts of the north, central Chile has a flora related to that of both, yet differing from each. From sea-level to the limit of shrubby growth on the mountains, thorny bushes are the characteristic plants. Most plants of the region show xerophytic modifications, for no rain falls from the first of September till the following June. By October the ground is fairly dry over the hills and higher land. By late November the green of winter and early spring is everywhere replaced by the brown of dry vegetation. The rapid rivers have cut deep valleys through the mountains and across the central plain, so that naturally mesophytic areas are found only in very narrow belts along the streams or in small mountain marshes. An extensive irrigating system has modified these natural conditions in the central plain to a considerable extent.

About Santiago the floral regions may be determined largely by elevation. Thus, there is the central plain with an elevation varying from one thousand to fifteen hundred feet; the hills from fifteen hundred feet to the limit of tree-growth at from five to eight thousand feet, the limit being higher in the interior than in the outer ranges of mountains; above this comes the high mountain flora extending to the region of perpetual snow.

In the first region the typical plant is the thorn-bush (*espino*), *Acacia Cavenia*, a shrub usually under ten feet in height, but some-

times becoming a small tree. It blossoms in early spring when the leaves are first appearing. During the middle of the day the leaflets close together, diminishing the transpiring surface. Frequently the *espino* covers large areas with the regularity of trees in an orchard; such areas are called *espinales*. At other times it is found in company with other thorny shrubs, but always maintaining its position as the dominant form. Throughout the region introduced herbs have the ascendency over the native: *Brassica Rapa*, *Raphanus sylvestris*, *Capsella Bursa-pastoris*, *Sisymbrium officinale*, species of *Erodium*, *Foeniculum vulgare*, *Medicago maculata*, *M. denticulata*, *Trifolium repens*, *Hordeum jubatum*, *H. murinum*, *Fumaria media*, *Centaurea melitensis*, *Cynara Cardunculus*, and others are very common along the roadsides, at the edges of cultivated fields, on all waste land, and even on the lower mountain-slopes. During the summer these introduced plants make up the greater part of the vegetation. In the early spring a larger number of native plants are found; such as various species of *Oxalis* (*O. lobata*, *O. articulata* and *O. micrantha*), *Dioscorea humifusa*, *Sagina apetala*, *Trichopetalum stellatum* and *Leucocoryne ixioides*. Besides the *Acacia*, a few other shrubs or small trees are found, as *Prosopis juliflora* (*P. Siliquastrum*), *Cestrum Parqui*, and *Talguenea costata*. Several species of *Cuscuta* and *Senecio* are also common.

This region is the only one brought under cultivation to any extent. A large number of the country roads have been formed into *alamedas* by planting Lombardy poplars along the small irrigating ditches that run at each side. Below these poplars *Rubus ulmifolius* frequently is planted and often grows to a height of over fifteen feet, spreading out on each side to form an impenetrable wall, replacing the mud walls that usually border the roads.

Several small areas of this central plain have a very distinct flora. There are a few small lakes, such as Aculeo and Batuco, which are swampy along the shores. Also along the irrigating ditches there are occasionally swampy places. Here are found such plants as *Eleocharis palustris*, *Cyperus vegetus*, *Typha angustifolia*, *Potamogeton pectinatus*, *P. Berteroanus*, *Zannichellia palustris*, *Myriophyllum verticillatum*, *Lemna minor*, *L. gibba*, *Azolla magellanica*, and *Cotula coronopifolia*.

The low hill and mountain region may easily be subdivided, although the divisions can not be sharply limited. There is considerable difference between northern and southern exposures at the same elevation, and the upper limit of many species is higher in the interior mountains than in the outer ranges.

The flora of the hills that rise abruptly from the central plain, as Cerro Blanco, San Cristobel, Renca and San Bernardo, is intermediate between that of the mountains and that of the plains. The *Acacia* is still one of the characteristic plants, but with it are many other shrubs, *Talguenea costata*, *Lithraea caustica*, *Colletia ferox*, *Muehlenbeckia chilensis*, *Colliguaya odorifera*, *Ephedra andina*, and the tall, columnar *Cereus Quisco*. The clumps of *Ephedra* seem to be as numerous on these low hills as on the higher slopes, where it extends close to the snow-line. On the hills it may be from four to six feet high, though it is so commonly cropped by cattle that it rarely attains such a height, while near the snow-line it is a matted shrub six or eight inches high. The herbaceous plants are typically Chilean, though a few naturalized species, such as *Fumaria media*, *Erodium cicutarium*, *Convolvulus arvensis*, *Marrubium vulgare*, *Centaurea melitensis* and *Cynara Cardunculus* are common. In the early spring *Trichopetalum stellatum*, with its delicately fringed white flowers, *Leucocoryne ixioides*, *Pasithea caerulea*, blue and yellow *Sisyrinchium*, species of *Oxalis*, and other, chiefly bulbous, plants are common. A little later several species of *Calceolaria*, especially *C. nudicaulis*, *C. purpurea*, and *C. adscendens*, species of *Loasa*, *Cajophora*, *Bowlesia*, *Tropaeolum*, *Moscharia* and *Triptilion* are the characteristic plants. By the last of November most of the spring flowers have matured fruits and are in a resting condition that lasts until the winter rains begin. Throughout the summer flowers are rare. The most attractive are composites, species of *Mutisia*, *Centaurea chilensis* and *Triptilion* sp. There are also a large number of less showy species, including species of *Baccharis*, *Senecio*, *Conyza*, and *Erigeron*.

The mountains proper have a greater number of shrubs. Near the streams are a few small trees, *Maytenus Boaria*, *Blepharocalyx*, *Myrtus*, *Cryptocarya Peumus*, *Quillaja saponaria*, and *Kageneckia oblonga*, all evergreen. On the drier slopes are thorny

shrubs, *Talguenea*, *Colletia*, *Proustia pungens*, and others; poisonous shrubs, *Lithraea caustica*, *Colliguaya odorifera*, *C. integerrima* and *Cestrum Parqui;* and a few species of thornless broad-leafed trees, as the species of *Escallonia*. On the driest slopes are cacti, *Cereus Quisco* and smaller species, *Puya coarctata* and *Eryngium paniculatum*. The last two stand singly or in small groups and attract attention from a distance. *Puya* has a short prostrate trunk covered with the bases of dead leaves, at the end of which rises a crown of narrow, spine-toothed leaves often three feet long; from the center of this crown springs the flowering stalk, six to nine feet high, bearing a pyramid of blue-green flowers. These flowers contain an abundance of nectar and are much visited by bees and humming birds. *Eryngium paniculatum* resembles *Puya* in habit but is smaller. There are a few vines in this region. *Eccremocarpus scaber* is abundant in the moister situations, climbing over the shrubs and small trees, covering them with clusters of scarlet blossoms. In drier situations *Mutisia subulata* and *M. lincarifolia* climb over anything to be found, and with their large heads of bright red are among the few bright flowers of summer. Of other plants the more common are species of *Calceolaria*, *Tropaeolum*, *Patagonium*, *Verbena*, and composites. Except along the small streams the vegetation is scattered, so that the gray, brown, or reddish soil gives the prevailing colors to the mountain sides. Near the streams the vegetation is denser. A shrub frequently found along the streams is *Aristotelia Maqui;* the purplish berries are used by the country people to prepare a beverage or to color wine. Some of the *Myrtaceae* are also found along the streams, chiefly species of *Eugenia*, *Myrtus*, and *Blepharocalyx*, while the "peumo," *Cryptocarya Peumus*, the soap-tree, *Quillaja saponaria*, and *Kageneckia oblonga* become trees forty to fifty feet high. Where the ground is swampy *Drimys Winteri*, the only representative of the *Magnoliaceae* in Chile, is found.

At an altitude of about 5,000 ft. in the outer mountains and of 7,000 ft. in the interior, *Kageneckia angustifolia* is found, marking the upper limit of tree-growth. Above that comes the high mountain vegetation.

In this last region two zones are found. In the lower the

plants are mainly in large low clumps or mats, the "Polster" formation of Reiche; in the upper the plants grow singly or in widely separated small clumps. The mats in the lower zone may be of one or several species. They are usually so dense that the lower portions are nearly solid with stems and dead leaves, with the green of new growth mantling the surface. Near the tree-line *Valenzuelia trinervis* is one of the principal plants in such formations. It grows to one or two feet in height and often solidly covers areas twenty to thirty feet in diameter. Similar, though smaller, mats are formed by the thorny umbellifer, *Mulinum spinosum*, by the composite, *Chuquiraga oppositifolia*, by *Ephedra andina*, and by other shrubby plants. With these there are other plants, especially bulbous ones, that develop in the spring while the ground is saturated with the water from melting snow. *Anemone chilensis*, *Diposis Bulbocastanum*, and species of *Liliaceae* and *Amaryllidaceae* are among these. *Luzula chilensis*, *Eleocharis striatula*, and a few grasses are found in marshy spots. Somewhat higher, *Laretia acaulis* forms dense mats, species of *Calceolaria* are found associated with various composites, *Aldunatea*, *Chaetanthera*, *Aplopappus*, and *Nassauvia*, species of *Argylia*, and others, all low perennials, in other mats.

The highest formation is of plants so scattered and small that from a short distance the ground seems absolutely barren. Of the plants found at these high levels many are tiny things hidden between stones and only noticed on close examination. *Aldunatea chilensis* may be taken as typical of these. The plant consists of a rosette of tiny leaves covered with a grayish felt. From the middle of a cluster of forty or fifty leaves grows the head, like a tiny daisy, the whole plant so small that it could be hidden under a quarter-dollar. Similar in general characters are *Viola Philippii* and other acaulescent violets, except that instead of a central flower a ring of tiny blue-black violets peep out around the rosette of leaves, the whole plant being rarely an inch and a half in diameter; the stout rootstock is closely marked with the scars of former leaves and blossoms. Other plants of similar habit are *Aldunatea gnaphalioides*, *Plantago* spp., and *Astragalus Germaini*, while *Nastanthus agglomeratus*, *A. spathulatus*, and *Phacelia circinata* are somewhat larger but of the same general habit.

An interesting group of plants was found in a little basin above Laguna Negra where the ground was saturated with water from the glacier a short distance above. *Luzula chilensis*, *Ranunculus chilensis* and *Calandrinia affinis* were growing in a thick carpet of moss. The delicate blossoms of the *Calendrinia* seemed like flakes of snow scattered from the neighboring drifts. Near the lake below grew *Tropaeolum polyphyllum*, *Schizanthus pinnatus* and species of *Hexaptera*. In the lake itself stood *Juncus pictus* and farther out a sparse growth of *Myriophyllum elatinoides ternatum*.

As has been mentioned, the southern slopes of the mountains have a flora somewhat different from the northern, as the south slopes are cooler and moister. As a result the vegetation on southern exposures is denser and more varied than that on the northern. At lower elevations the plants best fitted for desert conditions, such as *Cereus* and *Puya*, are found only on the northern slopes, while *Escallonia*, *Calceolaria*, *Verbena*, *Lippia* and others are found, chiefly on the southern.

Nearly everywhere *Cereus* serves as host for *Loranthus aphyllus*, the clusters of red flowers always springing from the axils of the thorns. These blossoms are usually considered to be the blossoms of the cactus by the country people. *Loranthus tetrandus*, abundant on the poplars of the long alamedas of the plain, is a serious pest on fruit trees and is found on nearly all the shrubs of the lower mountains. Other species of *Loranthus* are occasionally found and are confined to certain plants; thus *Loranthus cuneifolius* was found only on *Porlieria hygrometrica*.

Except for the small number of water and swamp plants, *Typha*, *Myriophyllum*, *Hydrocotyle*, *Montia*, *Potamogeton*, *Senecio fistulosus*, *Cotula*, *Eleocharis*, *Juncus* and *Drimys Winteri*, nearly all the plants show xerophytic adaptations; and the waxy coating of the leaves of *Drimys* may be considered as a xerophytic modification. Many of the plants complete their growth during one or two months of early spring, while the ground is moist, and then spend the summer in a resting condition, storing in a bulb or other underground stem the food that enables them to make a vigorous start the following spring. *Diposis Bulbocastanum*, *Cardamine alsophila*, *Oxalis articulata*, *Tropaeolum tricolor*, *T. brachyceras*, *Pasithea coerulea*, and many others belong to this group.

A smaller number of plants develop their leaves early, and flower in the summer after the leaves have disappeared. Among these are several species of *Alstroemeria*.

Many reduce the leaf-surface; some, as the cacti and *Ephedra*, have no functional leaves at any season; others have a well-developed leaf-system during the spring, but lose their leaves in summer. *Colletia ferox*, leafy during early spring, is at other seasons a mass of naked, thorny branches, the green epidermis taking the place of the leaves. *Talguenea costata*, *Schinus dependens*, *Proustia pungens*, and many others retain but a very few leaves during the summer. Others, as *Baccharis sagittalis*, *Mulinum spinosum*, *Acacia Cavenia*, species of *Calendrinia*, *Mutisia* and *Nassauvia*, have but a few small leaves throughout the growing period. Many, as *Aldunatea*, species of *Viola*, *Chuquiraga*, and *Nassauvia*, have small leaves closely crowded in rosettes or appressed closely to the stems. The crowding of the leaves in the mat formations of the mountains results in a reduced transpiring surface as well as protection from wind and snow.

Most of the trees are evergreen and have a waxy covering on the leaves. *Quillaja saponaria*, *Boldoa fragrans*, *Lithraea caustica*, *Kageneckia oblonga*, *Colliguaya* spp., *Escallonia arguta* and others have one or both sides of the leaves covered with a wax or varnish. A somewhat smaller number of plants have a resinous coating, among them several species of *Baccharis*, *Madia sativa*, *Cephalophora aromatica* and *Fabiana imbricata*. The last of these also has the leaves very small and closely appressed to the stems. Others, especially mountain plants, have the leaves densely covered with hairs; such are species of *Gnaphalium*, *Astragalus*, *Aldunatea* and *Patagonium*. During the middle of the day the leaflets of *Acacia Cavenia*, *Porlieria hygrometrica*, *Patagonium arboreum*, and a few other shrubs fold together, reducing the leaf-surface and placing the leaves edgewise to the sun's rays.

Nearly all the plants of the region have an extensive and usually deep root-system. The cacti, *Puya*, and certain orchids, as *Chloraea*, have fleshy stems that serve as water-reservoirs. *Alstroemeria*, *Oxalis*, and many others store water in the underground stems. Specimens of *Pasithea coerulea* had so much water in the stems and tubers and were so well protected by a waxy

covering that after being put in press fruits were matured from flowers that had just opened when they were put between the driers.

While several of the plants collected are not described in Gay's Historia de Chile, nearly all were found in the volumes so far pub-

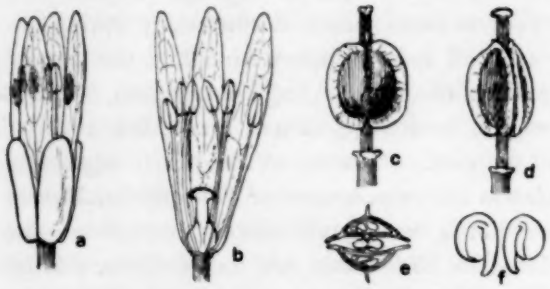


FIGURE 1. *Hexaptera purpurea* sp. nov. *a*, flower; *b*, flower, with one petal and two sepals removed; *c*, fruit, dorsal view; *d*, fruit, lateral view; *e*, fruit, transverse section; *f*, embryos.

lished of Reiche's Flora de Chile, that belonged to the orders therein described. Therefore, no attempt has been made to describe new species, with the exception of a *Hexaptera* (a small genus of the *Cruciferae* occurring only in Chile) found in the mountains near Laguna Negra.

Hexaptera purpurea sp. nov.

Perennial; stems 1–5, simple, smooth, green or purplish, 25–35 cm. high: leaves crowded at base of stem, narrowly spatulate, 5–7 cm. long, 2–5 mm. broad near the apex, tapering to the base, entire or with 1 or 2 sharp teeth near the apex, smooth, slightly fleshy; upper leaves few, smaller, 2–3 cm. long, 1–2 mm. broad: raceme terminal, simple or with 1–5 branches: flowers crowded: branches and stems elongating slightly after flowering so that the fruits are nearly separated except at the ends of the branches: peduncles 1–2 mm. long: sepals oblong, 4 mm. long, violet or black, erect: petals twice as long as the sepals, yellowish, violet on outer sides near tips: stamens free: fruit purple, the narrow wings white or slightly tinted.

Among rocks, near Laguna Negra, 3,500 m., province of Santiago, *Hastings 480*, February 6, 1902.

Distinguished from *H. linearis* Barn. by the numerous leaves

at the base of the stems, the leaves tapering to petioles, the branching, many-flowered racemes, and the violet-tinted petals.

Acknowledgment is due Prof. W. W. Rowlee for advice and assistance in determining the species collected, and to Cornell University for the use of a large amount of literature on the flora of Chile.

The species were named according to Reiche's "Flora de Chile," as far as published; otherwise the names are those given in Philippi's "Catalogus plantarum vascularium chilensium."

WENONAH, NEW JERSEY.

NOVEMBER, 1905.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1905)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omission their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers, at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card-issue should be addressed to the Treasurer of the Torrey Botanical Club.

Abrams, L. R. Studies on the flora of Southern California. Bull. Torrey Club **32**: 537–541. 21 O 1905.

Including descriptions of new species in *Hookera*, *Abronia* (2), *Delphinium*, *Acrolasia*, *Sphaerostigma*, *Godetia*, *Gilia*, and *Diplacus*.

Adams, C. C. The post-glacial dispersal of the North American biota. Rep. Eighth Internat. Geogr. Congr. 623–637. *map.* 1905.

Anderson, R. J. The flora of Connaught as evidence of the former connection with an Atlantic continent. Rep. Eighth Internat. Geogr. Congr. 613–615. 1905.

Arechavaleta, J. Flora Uruguaya **2**: 161–377. *pl. 1–35 + f. 1–5.* 1905.

Anal. Mus. Nac. Montevideo, vol. 5.

Bain, S. M. & Essary, S. H. A preliminary note on clover diseases in Tennessee. Science II. **22**: 503. 20 O 1905.

Baker, E. G. Notes on *Cardamine*. Jour. Bot. **43**: 254–256. S 1905.

Baker, J. G. A revised classification of roses, 1905. Jour. Linn. Soc. Bot. **37**: 70–79. 1 Jl 1905.

Beauverd, G. Plantae Damazianae brasilienses déterminées par différents botanistes. Bull. Herb. Boissier II. **5**: 284–287. 28 F 1905; 404–407. 31 Mr 1905.

Beauverd, G. Une nouvelle Burmanniacée du Brésil. Bull. Herb. Boissier II. **5**: 948. 30 S 1905.
Burmannia Damazii sp. nov.

Berry, E. W. An old swamp-bottom. Torreya **5**: 179–182. *f. 1.* 27 O 1905.

Blodgett, F. H. A nature study of Maryland plants. Md. Agr. Coll. Bull. **2**: 1–22. 1905. [Illust.]

Britten, J. Note on the history of *Cliftonia*. Jour. Bot. **43**: 282–284. O 1905.

Britton, E. G. The botanical congress at Vienna. Bryologist **8**: 80, 81. 1 S 1905.

Britton, N. L. Bermuda in September. Jour. N. Y. Bot. Gard. **6**: 153–158. *pl. 29, 30.* O 1905.

Brotherus, V. F. *Pleurorthrotrichum*, eine neue Laubmoosgattung aus Chile. Öfv. Finska Vet.-Soc. Förh. **47**[15]: 1–4. *pl.* 1905.
P. chilense gen. et sp. nov.

Brown, F. B. H. A botanical survey of the Huron River valley. III. Bot. Gaz. **40**: 264–284. *f. 1–5* + *map.* 18 O 1905.

Campbell, D. H. The structure and development of mosses and ferns (*Archegoniatae*). [Ed. 2.] i–vii. 1–657. *f. 1–322.* New York, S 1905.

Campbell, R. Some conspicuous British Columbia summer plants. Can. Rec. Sci. **9**: 176–189. 20 Ap 1905.

Cannon, W. A. A new method of measuring the transpiration of plants in place. Bull. Torrey Club **32**: 515–529. *f. 1–5.* 21 O 1905.

Chamberlain, E. B. Notes upon Maryland bryophytes and on two mosses from Virginia. Bryologist **8**: 77, 78. 1 S 1905.

Christ, H. Primitiae florae costaricensis. *Filices* et *Lycopodiaceae* III. Bull. Herb. Boissier II. **5**: 248–260. 28 F 1905.
Includes descriptions of 11 new species in 8 genera.

Clements, F. E. Research methods in ecology. i–xvii. 1–334. *f. 1–85.* Lincoln, Neb., 1905.

Collins, F. S. Phycological notes of the late Isaac Holden, — I. Rhodora **7**: 168–172. 19 S 1905.

Copp, G. G. The desert's natural reservoirs. Shields' Mag. **1**: 387, 388. N 1905. [Illust.]

Coulter, S. *Cuscuta americana* L. Proc. Ind. Acad. Sci. **1904**: 207–211. 1905.

Coulter, S. The poisonous plants of Indiana. Proc. Ind. Acad. Sci. **1904**: 51–63. 1905.

Cowles, H. C. Importance of the physiographic standpoint in plant geography. (Abstract.) Rep. Eighth Internat. Geogr. Congr. 600. 1905.

Cowles, H. C. A remarkable colony of northern plants along the Apalachicola River, Florida, and its significance. (Abstract.) Rep. Eighth Internat. Geogr. Congr. 599. 1905.

Curtis, C. C. The pines of the northwest. Shields' Mag. **1**: 383–385. N 1905. [Illust.]

Cushman, J. A. The desmid flora of Nantucket. Bull. Torrey Club **32**: 549–553. 27 O 1905.

Dams, E. *Cereus Wittii.* Monats. Kakteenk. **15**: 22. 15 F 1905. [Illust.]

Dams, E. *Mamillaria radians* P. DC. var. *impexicoma* S.-D. Monats. Kakteenk. **15**: 6. 15 Ja 1905. [Illust.]

Dandeno, J. B. The parachute effect of thistle-down. Science II. **22**: 568–572. *f. 1–4.* 3 N 1905.

Davis, W. T. A new station for the hybrid oak, *Quercus Brittoni* Davis. Proc. Nat. Sci. Assoc. Staten Island **9**: 38. F 1905.

Deam, C. C. Additions to the Indiana flora. Proc. Ind. Acad. Sci. **1904**: 219–221. 1905.

DeCandolle, C. *Meliaceae* costaricenses. Bull. Herb. Boissier II. **5**: 417–427. 29 Ap 1905.
Includes new species in *Guarea* (5), *Trichilia* (8), and *Cedrela.*

DeCandolle, C. Species novae brasilienses a L. Damazio lectae. Bull. Herb. Boissier II. **5**: 230, 231. *f. 1, 2.* 28 F 1905.
Lundia Damazii and *Oxalis Damazii* spp. nov.

DeCandolle, C. Sur le calice du *Lundia Damazii* C. DC. Bull. Herb. Boissier II. **5**: 228–230. *f. 1–8.* 28 F 1905.

Dismier, G. Note sur le *Webera annotina* auct. Rev. Bryol. **32**: 87–92. 1905. [Illust.]

Douglass, B. W. Additions to the flora of Marion County, with notes on plants heretofore unreported from the state of Indiana. Proc. Ind. Acad. Sci. **1904**: 223, 224. 1905.

Dowell, P. Additions to the flora of Staten Island. Proc. Nat. Sci. Assoc. Staten Island **9**: 41, 42. Mr 1905.

Drude, O. Die Methode der pflanzengeographischen Kartographie, erläutert an der Flora von Sachsen. Rep. Eighth Internat. Geogr. Congr. 608–612. 1905.

Earle, F. S. Nomenclature at the international botanical congress at Vienna. Science II. **22**: 468, 469. 13 O 1905.

Eckerson, S. The physiological constants of plants commonly used in American botanical laboratories. I. Bot. Gaz. **40**: 302–305. 18 O 1905.

Elrod, M. N. Pollination of *Campanula americana* and other plants. Proc. Ind. Acad. Sci. **1904**: 213–217. *f. a–d.* 1905.

Engler, A. Beiträge zur Kenntnis der *Araceae*. X. Bot. Jahrb. **37**: 110–143. 19 S 1905.

With descriptions of 79 new American species in 15 genera; including *Caladiopsis* gen. nov.

Engler, A. *Ulearum* Engl. nov. gen. Bot. Jahrb. **37**: 95, 96. 19 S 1905. [Illust.]

Fedde, F. Die geographische Verbreitung der *Papaveraceae*. Bot. Jahrb. Beibl. **81**: 28–43. 22 Au 1905.

Fernald, M. L. *Symphoricarpos racemosus* and its varieties in eastern America. Rhodora **7**: 164–167. 19 S 1905.

Fink, B. What to note in the macroscopic study of lichens. Bryologist **8**: 73–76. 15 Jl 1905; — II. Bryologist **8**: 86–90. 1 S 1905.

Freeman, E. M. Minnesota plant diseases. i–xxiii. 1–432. *f. 1–211*. Saint Paul, Minn., 31 Jl 1905.

Rep. Geol. & Nat. Hist. Surv. Bot. Series V.

Gibson, W. H. & Jelliffe, H. L. Our native orchids: a series of drawings from nature of all the species found in the northeastern United States. With descriptive text. i–xxxv. 1–158. New York, Je 1905. [Illust.]

Gilbert, B. D. The advantage of frequent visits to moss localities. Bryologist **8**: 93, 94. 1 S 1905.

Gürke, M. *Echinocactus Arechavaletai* K. Schum. Monats. Kakteenk. **15**: 106–110. 15 Jl 1905. [Illust.]

Harper, R. M. "Hammock," "Hommock," or "Hummock"? Science II. **22**: 400–402. 29 S 1905.

Harper, R. M. *Mesadenia lanceolata* and its allies. Torreya **5**: 182–185. 27 O 1905.

Harris, J. A. The fruit of *Opuntia*. Bull. Torrey Club **32**: 531–536. 21 O 1905.

Harshberger, J. W. Methods of determining the age of the different floristic elements of eastern North America. Rep. Eighth Internat. Geogr. Congr. 601–607. 1905.

Harwood, W. S. New creations in plant life: an authoritative account of the life and work of Luther Burbank. i–xiv. 1–368. New York, 1905. [Illust.]

Hassel, J. M. von. La industria gomera en el Peru. 1–29. Lima, 1905. [Illust.]

Hollick, A. Additional notes on the occurrence of amber at Kreischerville. Proc. Nat. Sci. Assoc. Staten Island **9**: 35, 36. Ja 1905.

Holm, T. Studies in the *Cyperaceae*. XXIV. New or little known *Carices* from Northwest America. Am. Jour. Sci. IV. **20**: 301–307. *f. 1–18*. O 1905.
Includes descriptions of 7 new species.

Holzinger, J. M. *Bryum Fosteri* n. sp. Bryologist **8**: 80. 1 S 1905.
A new name for *B. Baileyi* Holz., not *B. Baileyi* Broth.

Howe, J. L. A tree's limb without bark. Science II. **22**: 527, 528. 27 O 1905.

Howe, R. H. *Lotus tenuis* as a waif in Rhode Island. Rhodora **7**: 167, 168. 19 S 1905.

Hua, H. *Metastelma longisepalum* Hua, Asclepiadacée nouvelle du Brésil. Particularités morphologiques inaperçues du groupe auquel elle appartient. Bull. Herb. Boissier II. **5**: 97–99. 31 Ja 1905.

Kinney, A. S. Outline of a course in plant culture. Plant World **8**: 234–258. [O] 1905.

Kraemer, H. Further observations on the structure of the starch grain. Bot. Gaz. **40**: 305–310. 18 O 1905.

Kraemer, H. Plant morphology and taxonomy. Am. Jour. Pharm. **77**: 401–416. S 1905.

Kränzlin, F. *Calceolariae* generis species novae (septem) centrali- et austro-americanae. Repert. Nov. Sp. **1**: 82–85. 20 S 1905; 97–107. 30 S 1905.
Descriptions of 29 new species, one from Mexico, the remainder South American.

Kränzlin, F. *Orchidaceae* novae austro-americanae plerumque peruanae. Repert. Nov. Sp. **1**: 85–92. 20 S 1905.
Descriptions of 13 new species in 8 genera.

Lemmerman, E. Das Phytoplankton des Meeres. III. Beitrag. Beih. Bot. Centralb. **19**[2]: 1–74. 1905.

Lindau, G. *Acanthaceae* americanae IV. Bull. Herb. Boissier II. **5**: 367–374. 31 Mr 1905.

Descriptions of 10 new species in 7 genera, including *Diateinacanthus* gen. nov.

Lloyd, F. E. The artificial induction of leaf-formation in the ocotillo. Torreya **5**: 175–179. *f. 1, 2.* 27 O 1905.

Lloyd, F. E. The barley-corn. I. Some points of structure. Plant World **8**: 223–232. *f. 40–48.* [O] 1905.

Lyon, F. The spore-coats of *Selaginella.* Bot. Gaz. **40**: 285–295. *pl. 11, 12.* 18 O 1905.

McCallum, W. B. Regeneration in plants. II. Bot. Gaz. **40**: 241–263. *f. 1–9.* 18 O 1905.

MacDougal, D. T. In the delta of the Rio Colorado. Shields' Mag. **1**: 369–377. N 1905. [Illust.]

Macoun, W. T. Why our field and roadside weeds are introduced species. Ottawa Nat. **19**: 124, 125. 11 S 1905.

Mann, A. Diatoms, the jewels of the plant-world. Smithson. Misc. Coll. **48**: 50–58. *pl. 22–25* + *f. 8–16.* 23 My 1905.

Maxon, W. R. A new species of fern of genus *Polypodium* from Jamaica. Smithson. Misc. Coll. **47**: 410, 411. *pl. 57.* 5 Ap. 1905.

P. nesioticum sp. nov.

Mez, C. Additamenta monographica 1904. Bull. Herb. Boissier II. **5**: 100–116. 31 Ja 1905; 232–247. 28 F 1905; 527–538. 31 My 1905.

New American species in *Tillandsia* (13), *Guzmania* (10), *Glomeropitcairnia* gen. nov., *Silvia, Aniba, Endlicheria* (2), *Ocotea* (11), *Nectandra* (2), *Grammadenia, Cybianthus, Geissanthus, Conomorpha, Comomyrsine, Rapanea* (2), and *Clavija.*

Pease, A. S. Notes on the accentuation of certain generic names. Rhodora **7**: 157–161. 19 S 1905.

Peckolt, T. Volksbenennungen der brasilianische Pflanzen und Produkte in brasilianischer (portugiesischer) und von der Tupisprache adoptiren Namen. Pharm. Rev. **23**: 76–80. Mr 1905; 236–238. Au 1905.

Penhallow D. P. The mycelium of dry rot. Can. Rec. Sci. **9**: 318. 15 My 1905.

Penhallow, D. P. Observations upon some noteworthy leaf-variations, and their bearing upon palaeontological evidence. Can. Rec. Sci. **9**: 279–305. *f. 1–11.* 15 My 1905.

Perrédès, P. E. F. London botanic gardens. Am. Jour. Pharm. **77**: 451–459. *pl. 1–7.* O 1905; 523–530. *pl. 8.* N 1905.

Peterson, M. G. How to know wild fruits: a guide to plants when not in flower by means of fruit and leaf. i–xliii. 1–340. New York, My 1905. [Illust.]

Piper, C. V. *Agropyron tenerum* and its allies. Bull. Torrey Club **32**: 543–547. 21 O 1905.

Radlkofer, L. *Guareae* species duae novae costaricenses. Bull. Herb. Boissier II. **5**: 191–193. 31 Ja 1905.
G. rhopalocarpa and *G. bullata* spp. nov.

Radlkofer, L. *Sapindaceae* costaricenses determinatae novaeque descriptae. Bull. Herb. Boissier II. **5**: 319–328. 31 Mr 1905.
Includes new species in *Paullinia* (4), *Thouinia*, and *Cupania*.

Radlkofer, L. *Sapindaceae* novae e generibus *Serjania* et *Paullinia* (collectionum Ule, Weberbauer, Smith et Williams). Bot. Jahrb. **37**: 144–155. 19 S 1905.
Descriptions of new species in *Serjania* (8) and *Paullinia* (7).

Ramaley, F. The botanical garden at Buitenzorg, Java. Pop. Sci. Mo. **67**: 579–589. N 1905. [Illust.]

Rolfe, R. A. *Mormodes buccinator* var. *aurantiacum*. Curt. Bot. Mag. IV. **1**: *pl. 8041*. 1 O 1905.
Native of tropical America.

Rose, J. N. Five new species of Mexican plants. Proc. U. S. Nat. Mus. **29**: 437–439. 1905.
New species in *Polianthus*, *Nolina*, *Parnassia*, *Heuchera*, and *Dahlia*.

Rose, J. N. Two new umbelliferous plants from the coastal plain of Georgia. Proc. U. S. Nat. Mus. **29**: 441, 442. *pl. 3*. 1905.
Harperia nodosa gen. et sp. nov., and *Zizia arenicola* sp. nov.

Rose, J. N. & House, H. D. Descriptions of three Mexican violets. Proc. U. S. Nat. Mus. **29**: 443, 444. *pl. 4*. 1905.
Including a description of *Viola Painteri* sp. nov.

Rydberg, P. A. Explorations in Utah. Jour. N. Y. Bot. Gard. **6**: 158–165. O 1905.

Sargent, C. S. Recently recognized species of *Crataegus* in eastern Canada and New England — VI. Rhodora **7**: 162–164. 19 S 1905.
Two species are described as new.

Sargent, F. L. Lichenology for beginners — III. Bryologist **8**: 81–86. *f. 7–17*. 1 S 1905.

Schneider, A. Contributions to the biology of rhizobia. V. The isolation and cultivation of rhizobia in artificial media. Bot. Gaz. **40**: 296–301. 18 O 1905.

Schneider, C. K. Uebersicht über die spontanen Arten und Formen der Gattung *Spiraea* (*Euspiraea*). Bull. Herb. Boissier II. **5**: 335–350. 31 Mr 1905.

Recognizes 57 species, of which 8 or 9 are (North) American.

Simmons, H. G. Remarks about the relations of the floras of the northern Atlantic, the Polar Sea, and the northern Pacific. Beih. Bot. Centralb. **19**[2]: 149–194. 1905.

Smith, C. P. Notes upon some little known members of the Indiana flora. (Paper number two.) Proc. Ind. Acad. Sci. **1904**: 301–303. 1905.

Sodiro, L. Plantae ecuadorenses. IV. Bot. Jahrb. **36**: 377–388. 22 Au 1905.

Including new species in *Monnina* (4), *Maytenus* (2), *Paullinia*, *Dunalia*, *Acnistus*, *Iochroma* (4), and *Poecilochroma*.

Sprague, T. A. *Manettiarum* pugillus. Bull. Herb. Boissier II. **5**: 264–267. 28 F 1905.

Includes descriptions of 4 new species.

Sprague, T. A. *Manettiarum* pugillus alter. Bull. Herb. Boissier II. **5**: 832–836. 31 Au 1905.

Includes descriptions of 5 new species.

Sprague, T. A. Plantarum novarum vel minus cognitarum diagnoses. Bull. Herb. Boissier II. **5**: 700–704. 30 Je 1905.

Includes new American species in *Anona* (2), *Apeiba*, and *Mollia*.

Stevens, F. L. The science of plant pathology. Jour. Elisha Mitchell Soc. **21**: 61–75. 20 S 1905.

Reprinted from Pop. Sci. Mo. **67**: 399–408. S 1905.

Tidestrom, I. Notes on the gray polypody. Torreya **5**: 171–175. *f. 1*. 27 O 1905.

Marginaria polypodioides (L.) Tidestrom, nom. nov.

True, R. H. Notes on the physiology of the sporophyte of *Funaria* and of *Mnium*. Beih. Bot. Centralb. **19**[1]: 34–44. 1905.

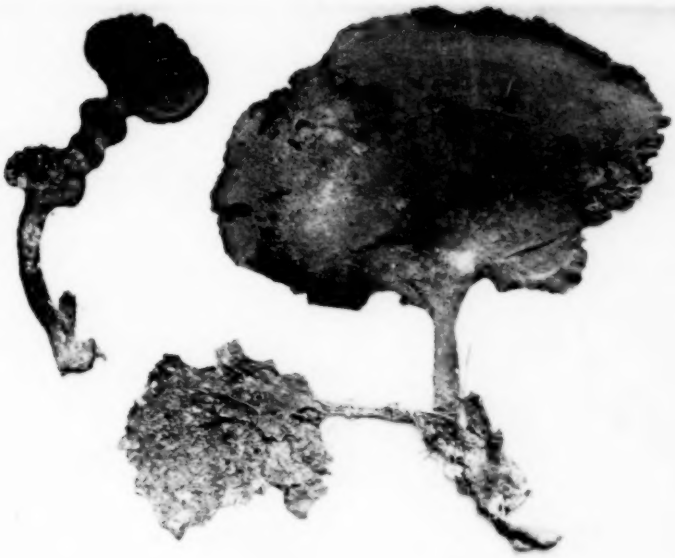
Ule, E. Biologische Eigentümlichkeiten der Früchte in der Hylaea. Bot. Jahrb. Beibl. **81**: 91–98. 22 Au 1905. [Illust.]

VanHorne, M. Some mushrooms found in Canada. Can. Rec. Sci. **9**: 157–175. 20 Ap 1905.

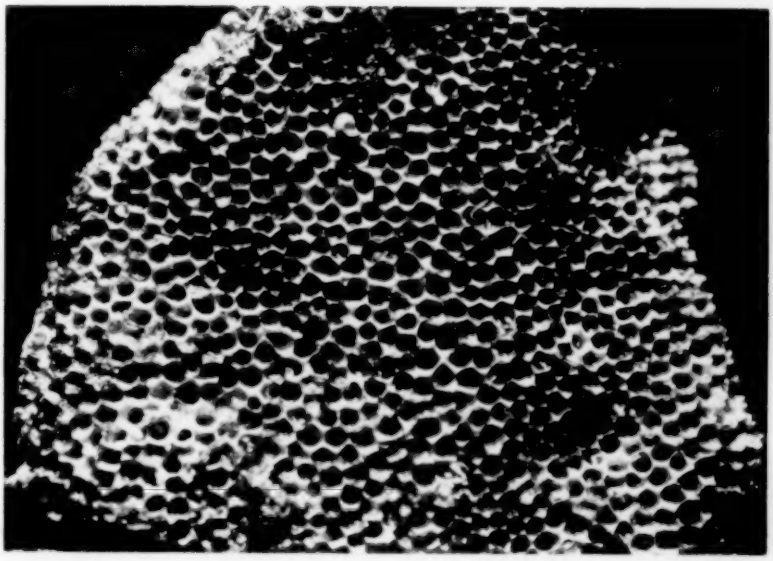
Warburg, O. *Myristicaceae* costaricenses. Repert. Nov. Sp. **1**: 71, 72. 20 S 1905.

Compsoneura costaricensis and *Virola Koschnyi* spp. nov.

Weberbauer, A. Anatomische und biologische Studien über die Vegetation der Hochanden Perus. Bot. Jahrb. **37**: 60–94. 19 S 1905.



1



2

1. AVRAINVILLEA LEVIS M. A. Howe
2. HALIMEDA FAVULOSA M. A. Howe

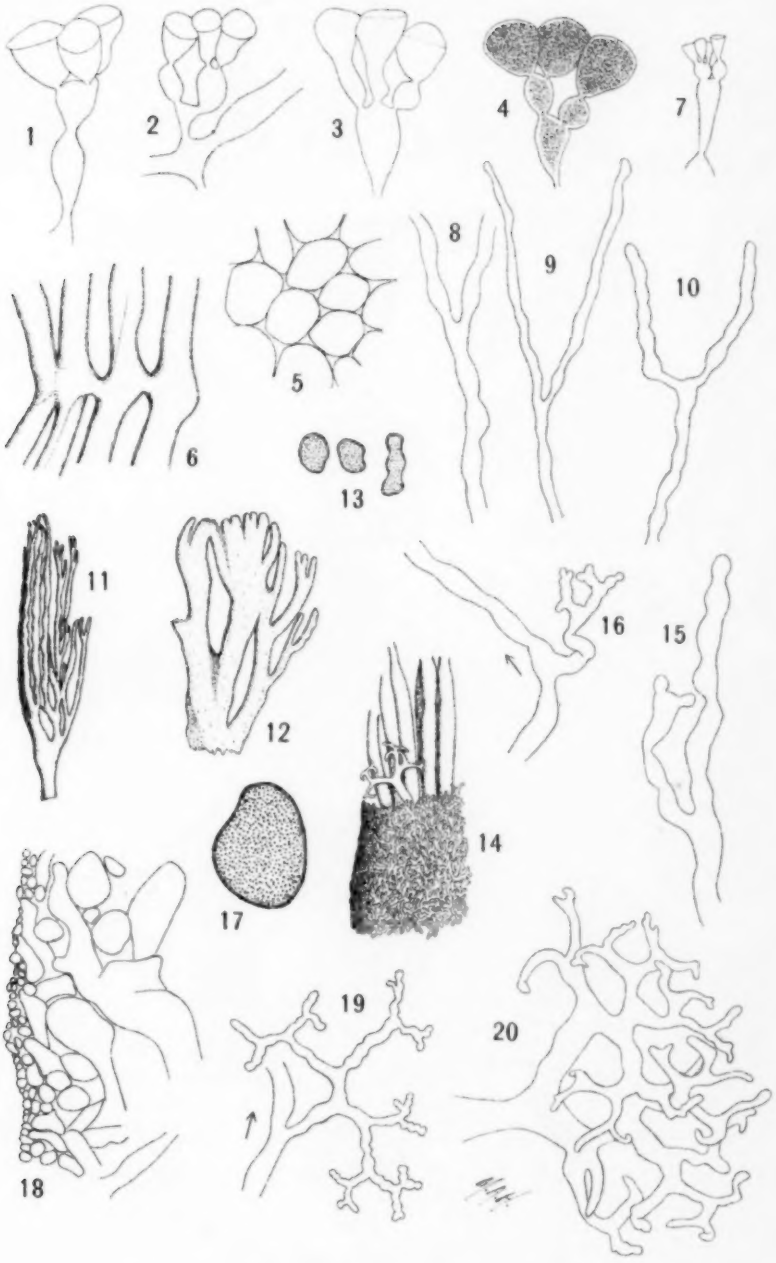
HELIOTYPE CO., BOSTON.

HALIMEDA FAVULOSA M. A. Howe

HELIOTYPE CO., BOSTON.

CLADOCEPHALUS SCOPARIUS M. A. Howe

HELIOTYPE CO., BOSTON.



1-6. HALIMEDA FAVULOSA M. A. Howe

7. HALIMEDA TRIDENS (Ell. & Soland.) Lamour.

8-10. AVRAINVILLEA LEVIS M. A. Howe

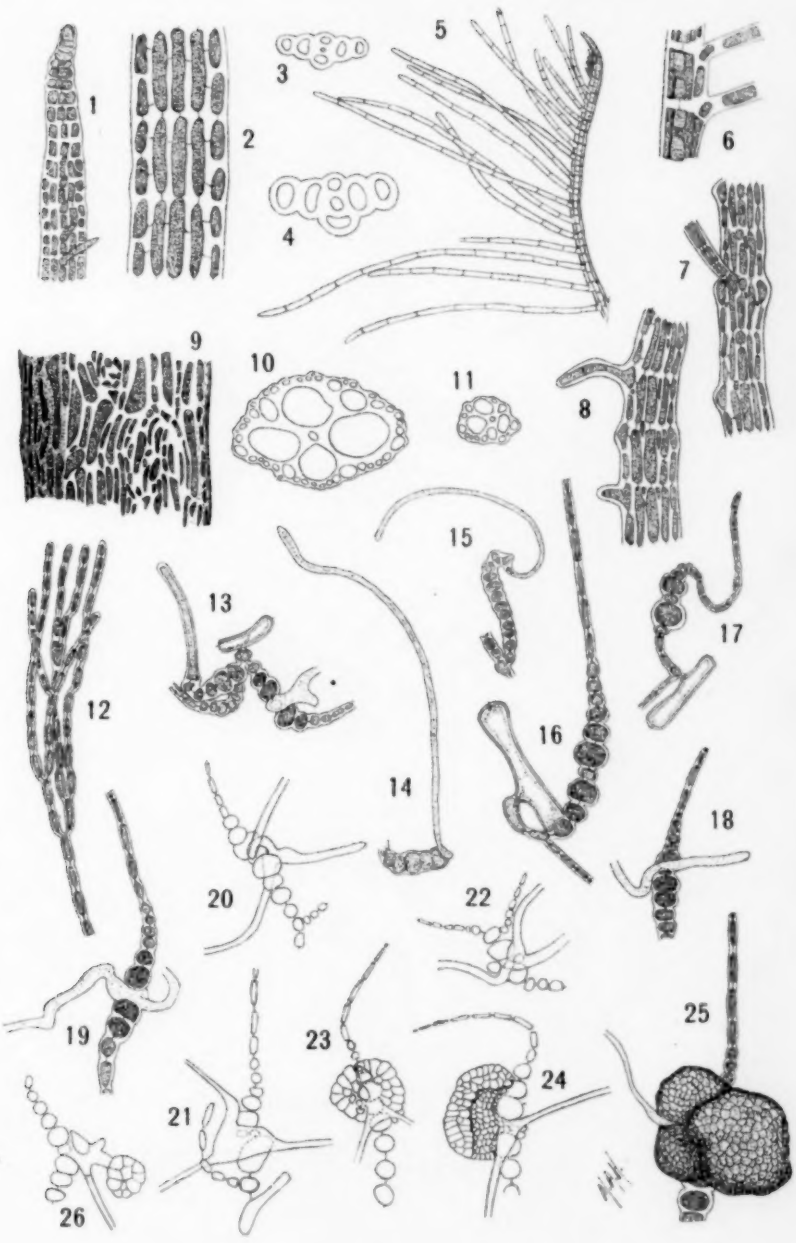
11-20. CLADOCEPHALUS SCOPARIUS M. A. Howe

SARCOMENIA FILAMENTOSA M. A. Howe

HELIOTYPE CO., BOSTON.

DUDRESNAYA CRASSA M. A. Howe.

HELIOTYPE CO., BOSTON.



1-11. SARCOMENIA FILAMENTOSA M. A. Howe

12-26. DUDRESNAYA CRASSA M. A. Howe